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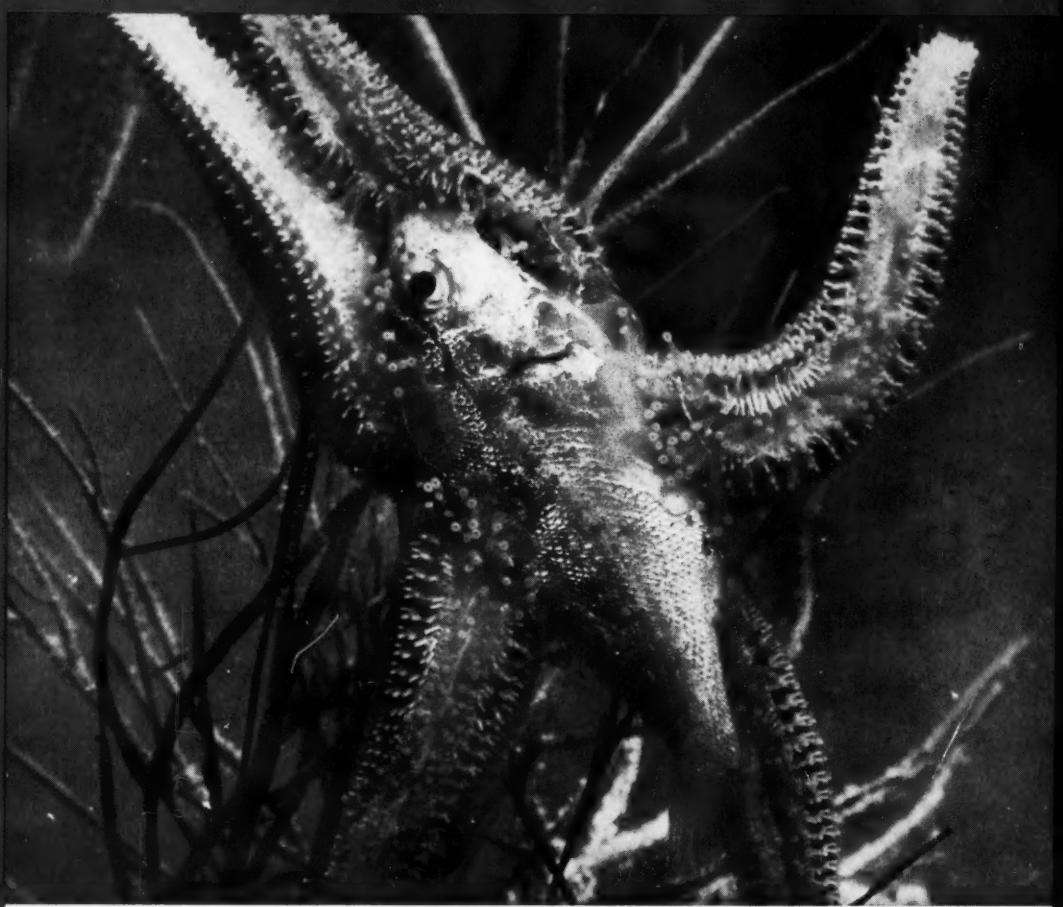

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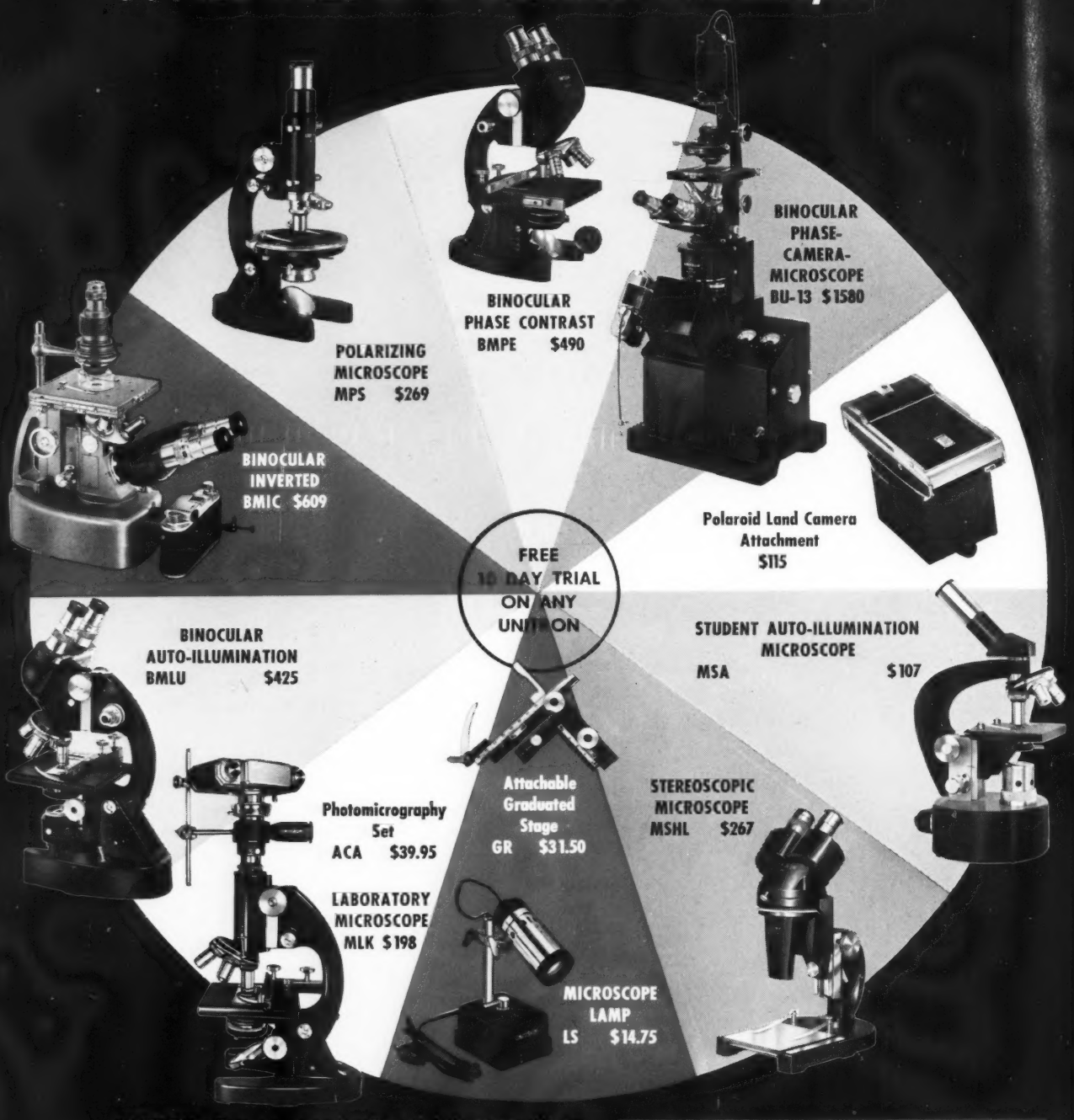
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* * *

COVER. A sea star, *Asterias forbesii*, Desor, confined in an exhibit tank at the Virginia Fisheries Laboratory, succeeded in overpowering an injured spot, *Leiostomus xanthurus Lacepede*. The transparent stomach of the sea star can be clearly seen surrounding and digesting the fish. Photo by Robert Bailey, Virginia Fisheries Laboratory, Gloucester Point, Va.

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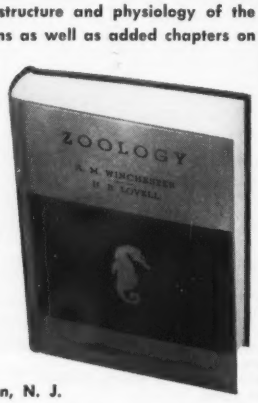

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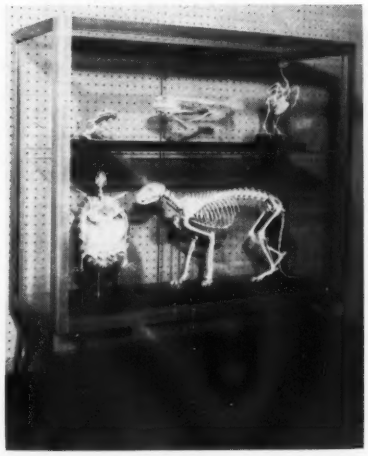

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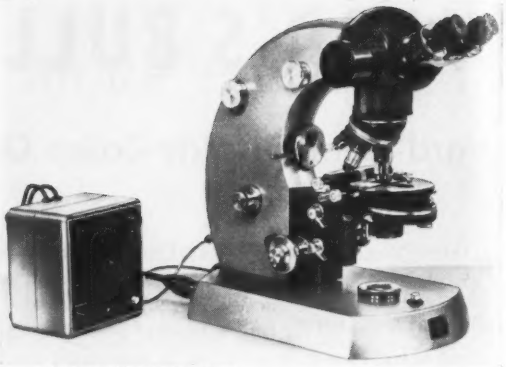

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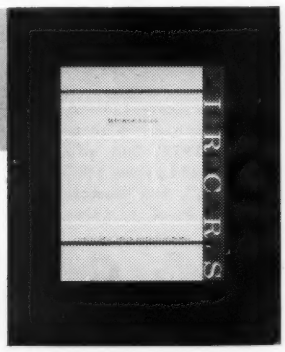

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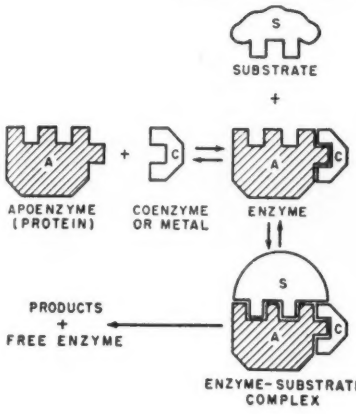

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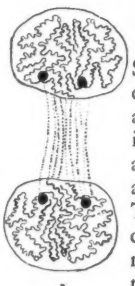

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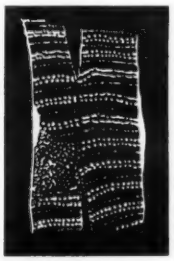

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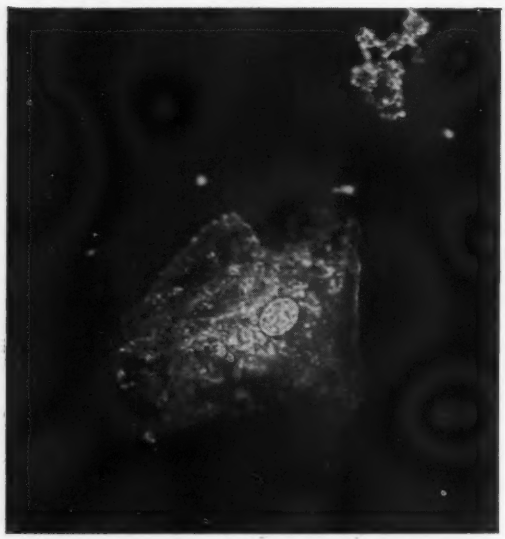

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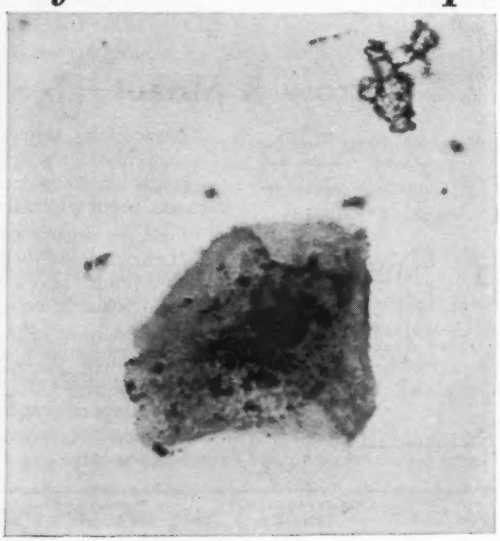

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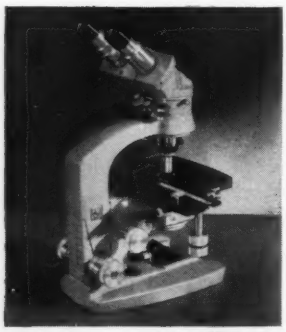

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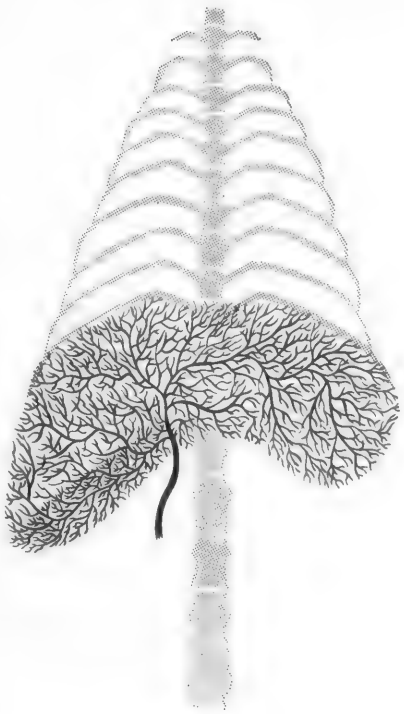

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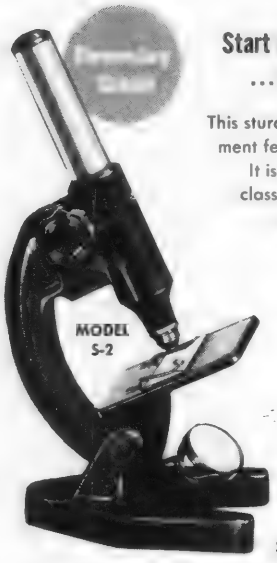

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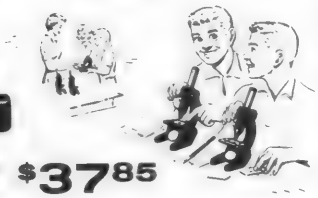

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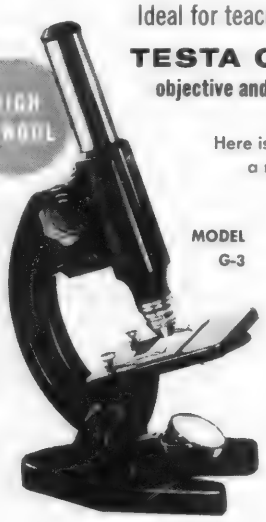

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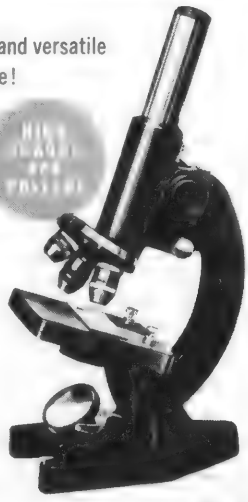

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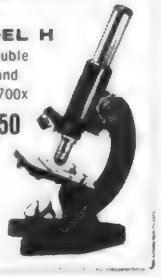

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The Role of Plant Pathology in the Scientific and Social Development of the World*

E. C. STAKMAN, *University of Minnesota, St. Paul*

"THE history of man is the record of a hungry creature in search of food." Thus wrote van Loon in *The Story of Mankind* (1). The statement may shock some people but it will not even surprise biologists, who are concerned with problems of life and what sustains it and of death and what causes it. They are more likely to be shocked by the general lack of comprehension of the basic truth in the statement. Primitive man must have led a precarious existence, both because of the uncertainty of food supplies and the uncertainty of continued existence in the face of violence and disease. The fundamentally biological nature of many of man's problems is too often overlooked; much history is indeed a record of man's attempt to assure his food supplies.

Man had to become at least a practical biologist in order to develop a civilization; and he has had to become a continually better biologist in order to preserve it. His most basic problems still are biological: human subsistence, human health, and human relations.

One of man's greatest mysteries is man himself. Being alive, he is concerned with life; knowing he must die, he is concerned with death. Even primitive man wanted to live; they wanted so much to continue to live that they believed in life after death. Nearly all men want to live long and they want to live comfortably; and some have faith that biology may enable them to realize their hope, even though they may not realize exactly what biology is.

Biology could be defined as the most important science in the world. Even the more ardent biologists, however, probably would insist that this is not a definition but mere statement of fact. And they would be right. In a world that is still populated largely by human beings, who are anthropocentric enough to be interested in themselves, in their persistence, and in their civilization, biology is a most important science.

In a highly industrialized and unbanized society there is a tendency to forget what life is and what sustains it—unless it is wildlife. In an age of mechanization there is a tendency to forget that machines do not make the food contained in cartons, cans, kegs and bottles—unless they make it more expensive. Only a catastrophic food shortage can shock many people into the realization that food production is a biological process carried on by plants and animals under the supervision of practical biologists, commonly known as farmers.

In countries which, like the United States, produce market surpluses of foodstuffs, it may be difficult to realize that about three-fourths of the people in the world are now hungry and that the population threatens to double within the next 40 years. Dare we be smugly unconcerned about the problems of feeding more than 5 billion people in 1998, when we cannot adequately feed half that number now? Surely we are not obtuse enough to think that we will be immune from the dangerous consequences of world overpopulation, even if we ourselves are not over-populated. Man is indeed "a hungry creature in search of food." And, unless biologists can teach him how to get it, he will write much future history in blood-red letters.

Biology is the hope of the world. It is the science that shows how better to sustain life and how to save it, how to produce food and how to protect against disease. But are lives to be saved from disease only to perish from hunger? It would be inhuman not to control diseases; we preach the doctrine of the sanctity of human life, and must live it. Society begged, and still is begging, medical science to make life long and painless. But is society really conscious of the enormous hunger pain in the world and of the scientific effort required to alleviate it? Must we ignore population explosions while preoccupied with other types of explosions? Shall we neglect life on earth while seeking life on other planets? Is it possible that our perspective is somewhat askew? We need not advocate less effort in exploration of space, but we do need far more effort to assure space for life on earth.

Like Bacon, many biologists ask "Is truth barren? Shall we not thereby be able to produce worthy effects, and to endow the life of man with infinite commodities?" Bacon pitted knowledge and invention against ignorance, hunger and poverty. In his *New Atlantis* he not only recognized scientists and technologists as special social assets, but he put them in charge of social affairs; he had them run the government so well that there was little need for government. There were no politicians, and the scientist governors were engaged in studying and controlling nature rather than in ruling men. Biologists were improving plants and animals that man might be better fed; they were improving medical science that man might longer enjoy their better food. Psychologists and sociologists were studying man that men might be better behaved. This was a vision of the unity and usefulness of science in a society that had the wit to utilize it.

The *New Atlantis*, thanks to biologists and other scientists, subsisted its own people, did not war for foreign markets, but sent "Merchants of Light" to the far corners of the earth to garner wisdom and bring it back to Solomon's House, the parliamentary body in which intelligence, not politics, reigned supreme. This was indeed Utopia, conceived three and a half centuries ago. Have we inched toward it or have we strayed afar? Do we need philosophers for Solomon's House to tell us that we cannot embellish life if we cannot sustain it? Was the idea of the *New Atlantis* so good that it was good for nothing? Or did some scientists read, "Men ought to know that in the theatre of human life it is only for gods and angels to be spectators," and profit thereby?

Conspicuous among the biologists who realized that they were neither gods nor angels were the plant pathologists. As they were not even angelic, they went to work on earthly problems; they went into the fields and the market places and tried to earn their keep by killing noxious plants in order that useful plants might live. And so it is time to tell plant pathologists what wonderful people they are. For plant pathology has come of age.

This is the jubilee year of the American Phytopathological Society and other biological societies are graciously participating in its celebration.

Plant pathology has a rich and varied history and a potentially brilliant future. The principal reason for going backward into history is to see more clearly what is ahead. But how far back do we need to go; when did plant pathology become a science? To adduce documentary evidence that plant diseases were destructive throughout the ages of recorded history is easy. It is harder, however, to evaluate their role in scientific and social development, because much of the evidence is purely circumstantial. Nevertheless, there are many eloquent testimonials that diseases were of such great and general concern as to affect attitudes and modes of thought in some ancient societies and in many modern ones.

Prayers, rituals, certain kinds of poetry, and legislation often are better indicators of social attitudes and thoughts than scientific literature.

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* Condensed version of an address delivered by Dr. Stakman at the Indiana University meeting of the American Institute of Biological Sciences, August, 1958. The address will be published in full in the special A.P.S. Golden Anniversary Symposium Volume.

Among Jehovah's terrible curses for disobedience were blasting and mildew; locusts and caterpillars; the botch of Egypt, scab, and itch; and blindness and madness (2). Solomon prayed for deliverance from "blasting, or mildew, locusts, or caterpillars." Amos and Haggai both stated that God actually had punished with blasting and mildew. Although the exact nature of blasting and mildew is not known, whether due to bad weather or bad pathogens, they obviously imply serious deviation from the normal, and can therefore be considered diseases. When plant diseases were among the severe penalties for wrongdoing, they must have been widely known and feared. They, therefore, made at least some contributions to the development of the moral code of ancient Israel.

"Stern Robigo, spare the herbage of the cereals; withhold, we pray, thy roughening hand . . ." is the beginning of a well-known prayer to Robigus, the special rust god of the Romans. The annual festival of the Robigalia is reputed to have been initiated by King Numa Pompilius, possibly about 700 B.C., and was continued with modifications into the Christian era. It was described by Ovid in his *Fasti*, a calendar of Roman festivals, and was held on April 25, about the time grain was heading, in a sacred grove five milestones from Rome (3). In his *Rerum Rusticarum*, probably the best Roman treatise on agriculture, Varro includes Robigus among the twelve councillor-gods who are the special patrons of the husbandman, distinct from "those urban gods, whose images stand around the forum, bedecked with gold, six male and a like number of female . . ." He invokes Father Jupiter and Tellus, Mother Earth, who "by means of the sky and the earth, embrace all the fruits of agriculture . . ." Sol and Luna are watched in all matters of planting and harvesting. The fruits of Ceres and Liber are most necessary for life; and it is "by their favor that food and drink come from the farm." Varro also invokes Robigus and Flora; "for when they are propitious the rust will not harm the grain and the trees . . .: wherefore, in honor of Robigus has been established the solemn feast of the Robigalia, and in honor of Flora the games called Floralia." (4)

In a polytheistic system there is likely to be specialization of function and form among the gods. That the twelve councillor-gods were assigned to agriculture is a tribute to the importance of Roman agriculture; that one of them was assigned full time to a single kind of plant disease is a tribute to the discernment of the Romans. At least they recognized the great importance of diseases and put both the gods and science to work in controlling them. As Varro says, ". . . on land that is unwholesome, however rich it may be, misfortune does not permit the farmer to reap a profit. For where the reckoning is with death, not only is the profit uncertain, but also the life of the farmers; so that, lacking wholesomeness, agriculture becomes nothing else than a game of chance. . . ." But the Romans apparently believed that the gods help those who help themselves, for Varro continues, "And yet this risk can be lessened by science." He mentions "the miasma which is exhaled in some spots" and refers to the skill of that "famous physician Hippocrates" in mitigating a great pestilence. Although the unwholesomeness of the land refers partly to malaria, it is clear that Varro had in mind the effect of site on plant diseases also.

To Varro and many other Romans science had to be practical; they were a practical people. Even their gods were practical, and they were practical about their gods. Three centuries after Varro, Constantine the Great, in 313 A.D., granted to Christians and all others freedom of worship "in order that whatsoever divinity and celestial power may exist may be propitious to us and to all who live under our government." Thus were all gods nationalized and put into the service of the state together.

Virgil's *Georgics* (5), published about 29 B.C., is almost as good an account of Roman agriculture as Varro's *Rerum Rusticarum* and, in some respects, more indicative of its role in the history of the Republic. After invoking the aid of the deities, Virgil traces the development of agriculture from the time when

". . . all was common, and the fruitful earth
Was free to give her unexacted birth."

But,

"Soon was his labour doubled to the swain,
And blasting mildews blackened all his grain;
Tough thistles choked the fields, and killed the corn,
And an unthrifty crop of weeds was born: . . ."

That plant diseases continued to vex and puzzle peoples after the fall of Rome is certain, although records are fragmentary and much is left to be conjectured. The so-called Dark Ages were not very articulate about the effect of plant diseases on social development. It seems improbable, however, that diseases declined with the decline of Rome, or that they had a private renaissance when the minds of men again awakened. The foul fiend Flibbertigibbit probably was not a sudden invention, but rather an evolutionary product in the minds of men to whom the cause of misfortunes was so obscure as to force resort to mystical explanation. Shakespeare probably was merely an accurate social reporter when he wrote in *King Lear*, about 1600,

> "This is the foul fiend Flibbertigibbet; he begins at curfew and walks till the first cock; he gives the web and the pin, squints the eye, and makes the hare-lip; mildews the white wheat, and hurts the poor creature of earth."

Theoretically, laws always express the will of society; and sometimes they really do. Whether legislation guides social development or merely reflects it, laws often are signposts that trace its course. In many ancient societies the enforcement of public health measures was entrusted to the priestly class; accordingly many people were accustomed to this type of regulation. But when positive secular laws were first enacted about plant diseases, they represented a change in mode of thought and considerable social development. Some good thoughts about plant disease were incorporated into laws long before the nature of disease was really understood.

The first known attempt to control a plant disease by legal measures was made about 300 years ago, when Rouen, France, required the destruction of barberry bushes in order to control stem rust of wheat (6). Although records of this law and its effects are obscure, it could well have represented a revolution in thought about at least one serious menace to food supplies. Connecticut, Massachusetts, and Rhode Island enacted barberry eradication laws, some very strict, between 1726 and 1766; and shortly after 1800 several German states took similar action. Today the barberry is proscribed in many northern grain-growing areas, but the early laws are especially significant in several respects.

The pioneer barberry-eradication laws represent a triumph of common sense over intellectual orthodoxy and authoritarianism. Practical agriculturists were concerned about rust because it menaced their daily bread, and it was their common experience that the menace was greatest near barberry bushes. Many scientists, however, maintained that it was not true, because they could not understand how it could be true. The farmers who lived with wheat did not know why barberry was baneful but they did know how baneful the barberry was. And so, unencumbered by preconceptions, they passed laws to eradicate the bane. How simple, and how significant!

Thus was born the concept of public health for plants. But not without pain. For the first law was enacted a hundred years before Fontana (7) and Targioni (8) announced their conviction that rust was a minute parasitic plant, disseminated by invisible seeds, and two hundred years before the Tulasnes showed that fungi could be pleomorphic and DeBary proved that stem rust was heteroecious. During two centuries, then, mandatory laws were passed about something that was known but not understood.

Truth still is truth, regardless of its origin; and truth can have values though not completely understood. But friction may produce sparks of understanding. The barberry controversy provoked thought and stimulated experimentation that soon confirmed observations regarding the effect of barberry on grain rust and later proved that a rust on barberry could be transferred to grain. But this would be transmutation of species, *Aecidium berberidis* to *Puccinia graminis*, which could not be sanctioned by scientific law. Facts violated law; did they have the right? When De-

Bary finally proved that the two presumed species were merely different phases of a single species, the riddle was solved. Or was it? Do we understand today why there are different phases? And when will we find out?

Wheat rust was a pioneer in impelling society to organize measures to help safeguard its food supplies by laws. The laws stimulated experimentation and research, which finally justified the pragmatic actions of society and helped revolutionize man's outlook. But rust was not the only social reformer. It must share honors, and dishonors with the potato murrain.

"Famine forces Peel's hand" is a chapter heading in McCarthy's *History of our Own Times* (9). Sir Robert Peel was Prime Minister of England when the terrible murrain devastated the potato fields of Ireland and destroyed the country's food. The epidemic itself is important in the history of plant pathology, for it intensified efforts to find out what caused the blight. But its social consequences loom large in the recent history of Britain and far beyond. Wheat rust had impelled legislation against an accessory to the disease, but the potato blight was a decisive accessory to legislation for social reform. It helped put an end to the protective tariff on imported grain, the so-called cruel Corn Laws. As McCarthy says, "The corn-laws, as all the world now admits, were a cruel burden to the poor and the working-class of England." The Anti-Corn-Law League had been agitating for the repeal of the laws, but neither major political party was willing to assume the risk of sponsoring repeal. But then, in the words of John Bright, one of the League leaders, "Famine itself, against which we had warred, joined us."

News came from Ireland in the autumn of 1845, that potato blight threatened to destroy "the food of a people." The Relief Committee of Dublin demanded that the ports be opened to free entry of grain and denounced the Ministry for its inaction. The Anti-Corn-Law League also was clamoring for the removal of restrictions on the importation of grain. And still the Conservative Cabinet did nothing, except appoint an anti-famine commission. But Lord John Russell, leader of the opposition Whigs, wrote to some of his constituents that "Indecision and procrastination may produce a state of suffering which it is frightful to contemplate. . . ." Potato blight had converted him to the principles of the League. This forced Peel's ministry to introduce a bill for the virtual abolition of the laws, and, after various vicissitudes, it was enacted into law in the summer of 1846. Britain was on the way to free trade.

Thus did a plant disease force reforms which may otherwise have been long delayed; the potato famine was too tragic for politicians to ignore. Whatever the true number of deaths, it is certain that Ireland quickly lost two million of her eight million people, from starvation, consequent disease, and emigration.

Plant pathologists have the ambition to relegate *Phytophthora infestans* and *Puccinia graminis* to their proper place in history and to keep them there. Both pathogens have made much history, much bad and some good. Plant pathologists have made good history by making these and other pathogens less terrifying, but it would be even better history if such agents of hunger and destruction could be expunged from all places except the history books. It may be feasible if the fight against them is intelligent, systematic, persistent, and worldwide. Possibly an international war against plant pathogens, hunger, disease, and ignorance might reduce the number of international wars.

Plant diseases have indeed played an important role in the social development of the world. Their greatest single contribution, of course, was the science of plant pathology itself. Society sired the science because it wanted help, and the science is doing its filial duty by helping with the chores and with the education of its sire. Exactly when plant pathology was born is a moot question; why it was born is no question at all. It was born of necessity.

For better or for worse, plant pathology had its genesis in fields and granaries more than in halls of ivy. Society needed agriculture and agriculture needed plant pathology. Of course plant disease excited curiosity, but the curiosity was more excited because the diseases struck in vital spots, the breadbaskets and the fields that filled them. It was essential to social progress that the baskets be filled, and men of scientific bent tried to fill them.

Not until the microscope was invented could there be a science of plant pathology based on understanding. Microorganisms had been postulated long before but they could not be proved. Even the practical Varro (4) stated as simple fact that minute invisible creatures were bred in swamps, were carried by the wind, and, when inhaled, caused serious diseases of humans. One can only speculate about what Varro might have discovered with the microscope. Without it he could explain certain phenomena only by creating minute creatures in his mind. His was the explanation of desperation; and for 16 centuries longer, explanations continued to be born of desperation.

The microscope, from about 1600 onward, was ready to reveal an entirely new world to those who would look for it. Not until a century and a half had passed, however, was it used systematically to elucidate the nature of plant diseases, for most botanists were preoccupied with other problems. The basis for a real revolution in concepts about disease was laid by three brilliant men in the second half of the 18th century: M. Tillet (11), Felice Fontana, and Giovanni Targioni Tozzetti.

Tillet was awarded prizes by the Royal Academy of Literature, Science, and Arts of Bordeaux for his work on bunt of wheat. In the introduction to his dissertation of 1755 Tillet states, "Here is a subject that surely will not be confused with those of pure curiosity; it concerns the people generally; it impinges upon their interest directly and merits, in many respects, the attention of the best natural scientists". In his *Observations on the Rust of Grain*, published in 1767, Fontana wrote, ". . . a sudden severe attack of rust ruined the grain all over Italy and especially in the province of Tuscany". Targioni, too, was impelled by this epidemic to study "The terrible scourge of rust. . . . (which) . . . merits the most serious attention of Naturalists . . .".

Brilliant pioneers though they were, these men were not the fathers of plant pathology, but they deserve almost more credit for having been its grandfathers. It was they who started the revolution that eventually modernized plant pathology. They substituted systematic observations and experimentation on diseases for scholastic argumentation about them. One small but important fact, however, eluded them.

By epoch-making experimentation Tillet proved conclusively that bunt of wheat was contagious, and he demonstrated that the smut dust, the spores, carried the contagion, but the nature of the contagion which they carried defied his understanding. Both Fontana and Targioni said categorically that wheat rust was caused by a microscopic parasitic plant, but they did not demonstrate it; they inferred it. They could not quite get the idea, sharply perceptive though they were, that the spores which they observed so carefully and described so accurately were the reproductive bodies of the rust plant instead of the rust plant itself.

There was just one more little hill to climb, and they did not quite get over the top. But they did succeed in changing man's way of looking at things, and that is one of man's greatest accomplishments, if the new look is better than the old. In this case it was. Targioni's comprehension was truly remarkable; and it would have been completely amazing if only he could have comprehended the true nature of spores instead of postulating that they produced myriads of invisible infectious particles. But who deserves the greater honor, he who first states a truth or he who first demonstrates it? And shall we fail to honor both for putting others on the path to truth?

What is the contagion in smut and how is rust contagious? These were the questions provoked by the work of the great triumvirate. Prévost answered the first part of the question in 1807, after years of experimentation and study (12). The component particles of the smut dust were the contagion, not merely the carriers of it; Prévost proved that they were the propagative bodies of the microscopic plant that causes the disease. He says, "I have incontestably established that the immediate cause of bunt is a plant of the genus of the uredos or of a very nearly related genus; that the growths of this

plant, as well as that of the majority of the uredos, begins in the open air and is completed within the plant that it attacks. . . . The majority of the plants of this class, which might be included under the general denomination of internal parasitic plants, or simply internal plants, are capable of making a part of their growth in water, or on very moist bodies. This presents an easy means of studying them and of proceeding to the investigation of preserving useful plants from their ravages." This is a long quotation in a short speech; but its implications are so far-reaching that it might as well have been the speech itself.

Prévost undertook to find a remedy for bunt or stinking smut of wheat, a vulgar subject and an unworthy object in the eyes of many of the purer scientists of that time. The methods used for controlling bunt were not effective, so Prévost set out to find a better one. He succeeded, and there is a tablet to his memory in Montauban, France, honoring him for it. But that is not honor enough. For his experimentation with preventatives drove him to more basic research on the nature of what he was trying to prevent. He found the preventative in copper sulphate and demonstrated that it prevented the development of a miscroscopic parasitic fungus. In commenting on the fact that Tessier regarded fogs as the cause of rust—a widely prevalent view—Prévost asserts that it is now proved that they are no more the cause of rust than of bunt, for "How could fogs be the cause of a plant?" Which was a very pertinent question.

Was not Bénédict Prévost the pioneer in establishing the germ theory of disease? He clearly demonstrated that a microfungus caused a plant disease, thus establishing the principle of pathogenesis.

"When once you had discovered me it was easy enough to find me". Thus spake Zarethustra (13). When once the cause of one disease was discovered, it should have been easy to find the causes of many more. But it was not. So the voice of the pioneers was unheard or unheeded by many of those—in many fields—who should have heard with profit. It took the authoritative works and words of DeBary and of Kühn to crystallize the essences of plant pathology and weave them into a coherent pattern.

As a science, plant pathology is scarcely a hundred years old. It now comprises not only a coherent pattern of activities but also a reasonably cohesive group of scientists. The early plant pathologists emerged largely from botany and gradually coalesced into groups with a core of common purpose. A pioneer concrescence, of the massive type, was the American Phytopathological Society.

A jubilee is a time for exultation; otherwise, why a jubilee? Surely a little modest boasting is tolerable. Surely pride of guild need not imply disparagement of other guilds.

The American Phytopathological Society has not only witnessed much scientific history but has helped to make it. Like plant pathology itself, the Society was born of need. Grave problems required solution, and, although the dollar sign was on many of them, the dollar was only a symbol of a surer and better life. The pioneers had but few dollars for their work, so they borrowed "a pluribus unum" from the dollar to help their dollars do more work. The demands on plant pathology have become so varied and diverse that manifold intellectual attainments and diverse skills are required to meet them. But there is a unity . . . in the purpose to solve practical problems and to contribute to human enlightenment. The American Phytopathological Society, model of efficiency in democracy, is a powerful synergistic system in furthering that purpose.

Plant pathology has helped reveal profound and useful truths. It was among the pioneers in revealing the vast and variable world of microorganisms and in identifying man's friends and foes amongst them. It has rendered similar services in the vastly significant field of virology, with its ramifications and applications to plants, animals, and humans. And it has helped elucidate the role of chemical microelements in the health and diseases of plants. It has not only helped man solve many of his most basic problems, but it has helped illuminate his intellect and expand his intellectual horizons; it has helped man to comprehend infinity in minutenes as he had begun to comprehend infinit magnitude. Plant pathology has helped t satisfy man's hunger for food and his thirs for knowledge. And is not that reason fo pride? May there ever be reason for mor and greater pride!

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The Biological Curriculum and the College Entrance Examination Board

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FOR many decades the College Entrance Examination Board has been the prime leader in the pursuit of excellence in American education, including biological education. Because it sets the examinations required of all candidates for admission to many colleges and universities, especially the better institutions, and literally from Maine to California, the College Board, to a very large extent, controls the curriculum in all secondary schools which aspire to prepare their students for college. How can it be otherwise, when the Board makes up the examinations? Such a predominant role, transcending both state and regional boundaries, places a heavy responsibility on this body.

To meet this challenging opportunity to guide American education, the College Board has set up a number of commissions and instituted several programs. One of the most productive is the Advanced Place-

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ment Program which covers not only biology, but also physics, chemistry, mathematics, history, and several languages. The purpose of the program is to give a forward thrust to secondary school and college education by providing a means whereby able and energetic students can progress at a more rapid pace than their less able or well motivated fellows. The program has shown a steady and vigorous growth during its six years of existence. Last spring over 360 secondary schools, widely scattered over the country, presented students for the special advanced placement examinations of the College Board.

The program itself is simple. During a student's final year in high school he takes one, or in some cases more, courses which are on the college freshman level. If he then does well in the College Board's nationwide Advanced Placement examination, he may skip the common freshman course in that particular subject when he goes into college the next fall and begin at once with the second year course. With few exceptions, the program works well. A recent study of a goodly number of students who had achieved advanced placement in Harvard and another group at the Massachusetts Institute of Technology showed that such students made academic records fully as high and usually higher than comparable students who had passed through the usual freshman courses. Whether or not a student actually enters a sophomore level course when he gets to college depends on the policy of the particular institution concerned. It is common practice for colleges and universities to open sophomore courses to students who have done well on the Advanced Placement examination. Very few institutions will also grant credit towards graduation for advanced placement work done in a secondary school.

The advantage of the program cuts deeper than merely permitting a student to be one course ahead in the academic procession. By offering more challenging work, and work which experience has demonstrated able high school students are capable of doing, the program stimulates the able students to far greater intellectual achievement and interest. It has been pointed out often enough that in contrast to English and Continental European education, the American system has not stressed the development of the superior student but has concentrated on education for all, including the handicapped. No humane person would argue against help for the slow learner. We are all slow learners in some realm. But for the welfare of society as a whole, including ultimately the slow learners themselves, the nurture of the superior student is far more pressing. This has doubtless always been true, but it is even more urgent in the fierce competition of the world as it is. The most important function of the program probably lies right here.

There are, of course, additional benefits. The presence of these high level courses inevitably tends to raise the general academic tone of the schools in which they are established. Some of the excitement and even some of the discipline seems to rub off on the students and teachers not directly involved in the program. From the standpoint of the college, there is evidence that by enabling students to move ahead more rapidly in their chosen field, or indeed in any field, this program has helped eliminate those scholarly doldrums popularly referred to as the "sophomore slump." In Baltimore, where a local advanced placement program has been in effect for over twenty years, there has been clear evidence that students who take an advanced placement course in a given field tend to major in that field when they get into college. In her well-known study of the origins and lives of scientists, Dr. Anne Roe found that many scientists, but biologists especially, showed a very early interest in what was to become their future vocation. It seems quite possible, therefore, that a vigorous advanced placement program in the sciences will increase the number of scientists produced.

There are, of course, disadvantages and even dangers involved in any advanced placement scheme. Students who have taken an AP course in biology in secondary school may elect or even be forced to repeat an essentially similar course freshman year in college. This situation is obviously wasteful and can easily be demoralizing. There may be doubt that a high score on a College Board AP examination is a sufficient guarantee that the secondary school course was in fact on the college level. This problem is very real with respect to laboratory work. Other problems arise out of the fact that the College Board gives a single examination, one and the same, for all the schools of the nation. Can this really be done without stifling all originality and experimentation in the curriculum? Will not the result be a "strait jacket" on our beginning biology courses which will permit no freedom for either experimentation or for adjustment to local needs and differences? As just suggested, there is a further but related complication. Because the Advanced Placement courses must be substantially and in many details the equivalent of college freshman courses, when the College Board sets the curriculum for these courses it must keep in mind the content and methods of the college freshman courses as well.

There are a number of ways of attempting to meet these problems. The hundreds of colleges and universities which constitute the College Board are found in every state in the Union and are as diverse as anyone could wish: compare tiny Albertus Magnus and the giant University of California, or West Point Military Academy, the California Institute of Technology, Randolph-Macon, Kalamazoo College, and Yale. To insure excellence and reality in the Advanced Placement curricula, the Board has designated a special series of committees. That for Biology, as published in the 1958 edition of the *Advanced Placement Program Syllabus*, was chaired by Dr. Willis Johnson of Wabash College who was also chairman of the National Research Council's Chapel Hill Conference on Undergraduate Curricula in the Biological Sciences. The other five members of the College Board committee were professors or teachers of biology at Harvard, Rutgers, Swarthmore, St. Louis Country Day School and the Woodrow Wilson High School, Washington, D. C. In the same year the readers for the AP examination in addition to Dr. Willis Johnson were biologists from Purdue, Vassar, Carleton, the Plainfield N. J. High School and the Germantown Friends School of Philadelphia.

To familiarize college and high school people with the Advanced Placement Program, and to seek solutions for this complex of problems, the College Board has held a series of annual three-day conferences, each conference devoted to one of the subject matter fields. The fifth in the biological sciences was held last spring at Goucher College. Of the 128 registrants from 19 states and one foreign country, 74 represented secondary schools, 51 represented colleges or universities, and 3, other kinds of institutions. The program was divided roughly into three parts: informational talks, round table discussions, and a general summary and drawing of conclusions.

The first of the six Round Tables, under the chairmanship of Dr. Russell Stevens of George Washington University, took up the question of the science sequence in our secondary schools. There have recently been widespread attempts, in New York State, Colorado, Illinois and elsewhere, to improve upon the commonly found sequence of "general" science in the 9th grade, Biology in the 10th, Physics in the 11th and Chemistry in the 12th.

One strong school of thought holds that the change most needed, if we are serious in our intention to give a forward thrust to science education in this country, is to push that necessarily amorphous thing, "general" science down into the 8th grade. Teach biology in the 9th grade where it is now taught in some schools anyway. Such a biology course should be primarily on the non-chemical level, with emphasis on gross and cellular anatomy and organ (in contrast to biochemical) physiology in plants, animals, and man, plus elementary Mendelism, evolution and diversity of life, ecology and conservation. Chemistry and Physics then come in the 10th and 11th grades. This kind of a sequence frees the final year, the 12th grade, for the student to take an Advanced Placement course in Biology or some other science. The common present sequence leaves no natural place for an advanced course, and, in fact, makes the introduction of such courses difficult.

There is also a very large vocal opposition to this kind of a proposal based, in large part, on the fact that it would push biology out of any senior high school which did not offer an Advanced Placement course.

The general conclusion reached by the Round Table and accepted by the conference was a compromise. For the present, it was held, there is no need to disturb the science sequence for the average student but a multi-track program of some kind is desirable for the more able students. It was recognized that such a double program, one track for the more and one for the less able students, would probably be feasible only in selected schools either public or independent. It was further emphasized that since biology is more dependent on chemistry and physics than these sciences are on biology, a course in high school chemistry should be a fixed prerequisite for an Advanced Placement course in biology, and that a previous course in physics was desirable.

There was considerable interest on the part of members of the Round Table and of the conference generally in a further conference specifically on the problem of the science sequence.

The second and third Round Tables were both concerned with the general problem of freedom and adaptability within the framework of excellence. This is truly a complex problem calling for the highest wisdom. The College Board has more than once been accused of exercising a tyrannical dictatorship over the secondary schools which dare not deviate from the CEEB line. College instructors would certainly kick like steers if everything they taught were to be controlled by an outside agency over which they exercised only a very feeble and remote influence. On the other hand, one of the most persistent criticisms of our educational system by Europeans is that it is no system at all but only a hodgepodge of the good, bad, and indifferent. Probably most of these foreign critics are not familiar with the working of the College Entrance Examination Board although it operates examination centers in some 125 foreign cities located in over forty countries. For our part, we might do well to remember the example of Germany and France which have long boasted of the most highly regimented school systems in the world. In one case, such a system did not save them from the criminal insanity of the Nazi master race theory; and, in the other, it has not prevented either debilitating political confusions nor scientific mediocrity. There may even be some doubt as to whether Russia and Japan have been wise in patterning their schools on these continental models.

The second Round Table, on Alternate Pathways, under the chairmanship of Mr. William Sweeney of the Choate School, concluded that the present Advanced Placement course syllabus published by the College Board does allow for considerable freedom within the framework of the course, and that this point should receive greater explicit emphasis in future editions of the CEEB Advanced Placement Syllabus (the so-called Acorn Book). This Round Table thought it better for secondary schools to lay foundations in general biology rather than to attempt specializations such as microbiology. They also pointed out that summer opportunities do exist for secondary school students with special interests, such as the work at the Bar Harbor Laboratory and special courses in local colleges.

The third Round Table, on Syllabus Specificity, under the chairmanship of Mr. David Schiff of Midwood High School, Brooklyn, N. Y., voiced very strong opposition to any increase in the specificity of the directions and content of the Advanced Placement syllabus and emphasized the importance of avoiding anything in the program which would tend to "strait jacket" the individual teacher. This stand was taken in the knowledge of earlier complaints that the syllabus had been so very general that it was virtually impossible for the instructor to know at what level a given topic should be taught or, more realistically, would be examined. This group urged a future workshop on the practical problems of teaching an AP course in biology. It also made recommendations about teachers for AP courses which will be considered along with the findings of the fifth Round Table.

The fourth Round Table, on the Relationship between Advanced Placement and Early Admission, was chairmaned by the Rev. F. J. MacEntee of St. Joseph's College, Philadelphia. It concluded, as shown by the Harvard and M.I.T. reports already mentioned and by the Ford Foundation Report on Early Admissions (whereby students enter college at the end of the junior year of high school), that both programs have worked well in practice. This Round Table emphasized that early admission requires more careful screening of the student for intellectual and emotional maturity than does simple Advanced Placement. Early admission would seem best suited to the exceptionally able student in a small high school which does not offer advanced placement courses, or for the student in a large school who would benefit by the challenge of a total college environment. Like other groups, this table recommended a better exchange of information between college admission officers and departmental chairman about students who had taken Advanced Placement courses.

The fifth Round Table, on Teacher Supply and Education, under the chairmanship of Mr. William Amos of St. Andrews School, Delaware, advocated the active encouragement by instructors of good students to enter the teaching of biology as a career, and also that efforts should be made to increase the financial and other rewards of the profession. Most essential, if the schools wish Advanced Placement courses which are essentially equivalent to college freshman courses, their governing bodies must accept realistically the fact that biologists require continuous study to keep up-to-date in a science advancing on many fronts. Among the ways of achieving this competence, this and other round tables suggested an initial year's leave of absence without jeopardy to position or tenure and financed largely by the school, grants, fellowships, etc. The various National Science Foundation sponsored summer refresher courses and institutes and various extension and in-service programs in local colleges provide opportunities for keeping abreast in sciences. It was also emphasized that a reduction in teaching load would be essential for anyone an Advanced Placement course. This round table suggested a two to one policy whereby one Advanced Placement course equals two ninth or tenth grade biology courses. The entire conference very strongly held that a minimum of ten hours per week would be essential to teach such an advanced course of which not more than seven should be contact hours.

Round Table Six, on the Relation of Advanced Placement to College Freshman Courses, was chairmaned by Dr. Reuben Torch of the University of Vermont. Several other round tables advocated that all students who take AP courses be required to take the AP examination, and that at least those which do well be barred by colleges from taking essentially similar courses after they reach college. This Round Table specified that a grade of 3 on a scale where 5 is the highest and 1 is the lowest should be the minimum to give actual advanced placement. The table was divided on whether a university should grant credit as well as advanced placement and whether passing an AP examination should satisfy a college science requirement. Like other round tables, this one advocated more and better exchange of information between colleges and universities and secondary schools.

Such are the main issues discussed last June by the College Board Conference on Advanced Placement in the Biological Sciences. Only one issue was put to a vote by the entire conference. In the present examination, one hour is devoted to wide-ranging short answer questions, and two hours to essay questions which of necessity cover fewer areas. The conference voted against increasing the proportion of time devoted to the short answer questions 3 to 2. It voted almost unanimously in favor of at least some increase in the choice among the essay topics.

On behalf of all biologists

CONGRATULATIONS TO NOBEL PRIZE WINNERS

George W. Beadle **Edward L. Tatum** **Joshua Lederberg**

Science Service and the Dissemination of Science

WATSON DAVIS, *Director, Science Service, Washington, D. C.*

IN these days of atomic energy, earth satellites, antibiotics, hybrid corn and a host of other bountiful and striking developments of science, it may seem that the popularization of science is so much a part of our culture that it need not be stressed or even discussed.

Yet the taking of the public into the confidence of scientists and the accurate but interesting reporting of biological, physical, chemical, medical and technological advances is hardly more than a third of a century old.

Science Service came into existence in 1921, in the aftermath of World War I, as the result of the conviction of a newspaper founder, E. W. Scripps, and a biologist, Dr. William E. Ritter, that science was important and that the public had a right to know about it. The cooperation of leading organizations in science was obtained, and Science Service is a non-profit educational and scientific organization with trustees nominated by the National Academy of Sciences, the National Research Council, the American Association for the Advancement of Science, the journalistic profession and the E. W. Scripps Estate.

Thousands of scientists and educators through the years have joined with trustees and staff in the work of Science Service.

For feeling and reporting the pulse of science, day by day, Science Service has a staff of scientist-writers at its headquarters in Washington, and contributors of scientific competence in the centers of research in America and abroad. The principal national and international science meetings are reported by staff or other scientist-writers. A large working information file and library provide quickly the necessary background to the current happenings in science.

Historically, Science Service began its work when newspapers understood little and cared less about science. To a major degree, science is appreciated and well-handled by newspapers today because of the ideals, example and practice of Science Service.

In its first decade of operation, Science Service's major contribution was that it made science acceptable to the American press and that it made science reporting acceptable and respectable in both newspaper and science circles. To a large extent the large gallery of science writers today, serving other press associations and newspapers arose from this pioneering.

Because Science Service for over three decades and a half has been a major channel for reaching a large portion of the reading public, we want everyone to know how we operate.

We cover the broad fields of science—physics, chemistry, medicine, biology, astronomy, anthropology, archaeology, psychology, mathematics, atomics, electronics etc.—by a specialized science writing staff, highly skilled scientifically and competent journalistically. In general, we do not ask our medical writer to cover atomic physics or our chemical writer to dig into archaeology.

Our first concern is to put into our wire and mail service to newspapers and other publications a complete coverage of science in all its aspects. This means that when there is a conference at which a paper is delivered, that conference and that paper is possible grist for our service to newspapers.

We put out the material daily by leased wire and by mail. Therefore, we want the information just as early as we can get it. Most effectively, we like to send out material under future release date which we call "Wire by Mail."

Each day in the early afternoon we prepare our two reports, one by wire and one by mail. The wire report is aimed primarily at newspapers publishing the next afternoon and is transmitted to them on overnight wires. The mail report carries the released-dated stories and spot material as well as a repeat of many of the wires. We thus have a daily closing date.

All of this material, together with additional photographs, etc., are made currently available to the *Science News Letter*. It is also available to *Chemistry* magazine.

A news-feature packet issued weekly contains an illustrated article on some important and interesting science topic. There is also a biological article, illustrated, under the heading Nature Ramblings, and a column on New Machines and Gadgets. Each month an astronomical feature, containing star maps, is produced, while another service consists of short paragraphs that can be used as fillers by newspapers.

The whole world of science is our beat. We follow and cover meetings, conferences and congresses by the hundreds. We watch scientific and technical journals by the score, often seeing page proofs before publication. We engage in corridor gossip with hundreds of scientists. We keep tele-

SCIENCE SERVICE, *organized in 1921 as a non-profit corporation, with trustees nominated by the National Academy of Sciences, the National Research Council, the American Association for the Advancement of Science, E. W. Scripps Estate and the Journalistic profession.*

phone contact with distant laboratories, following up research we know or sense is in progress.

Most of all, we endeavor to know what is going to happen or be printable tomorrow, or three or four days hence, or in the next month or two. What happened yesterday or last week or month is of much less interest, although in a few instances it can be top news.

So we have set up methods of getting papers in advance. We wire, phone and write for a copy of that speech that we know may be important. We do telephonic interviews. We invite scientists to send copies of articles, speeches and reports.

Above all, our stories must be "interesting, and true" not "interesting, if true." Our standards of accuracy are and must be high, perhaps higher than that of other science reporting efforts.

We are attempting to develop and utilize new and effective methods of science presentation. One of these is the *Science Service Grand Jury* technique, by which moot questions are put to a group of experts who answer with assured anonymity. Some of the verdicts are very different from what they would have been if the experts were being quoted by name.

Science News Letter is the personal subscription ($5.50 a year) weekly publication into which flow all of the editorial material developed by Science Service. It came into existence just after the beginnings of Science Service when individuals demanded direct access to our information. It is a compact, illustrated, easily read magazine, which contains a weekly listing of new science books published in addition to news coverage of the latest in all fields of science. Some 70,000 copies are printed each week.

Chemistry Magazine (8 times a year at $4) is a magazine for use by teachers and students in high school, supplementing texts and courses by bringing the latest information and opinion in the field of chemistry to its readers.

ERIC LAWRENCE RICKES—*This top winner, one of the four winners of the Ninth National Science Fair held at Flint, Michigan, indicated his concern for stopping the spread of the Dutch elm disease by attempting to find a method of controlling the fungus tree disease.*

Science Service has pioneered in inexpensive and simple experimental science kits. You have often read about something, such as a new fabric, an unusual material, or a novel gadget, and thought: "I wish I had a sample!" *Things of Science* units answer this sort of wish. Actual things are so much more interesting than mere words or pictures. This membership plan allows individuals and science classes and groups to look at, try out, feel, and actually own unusual *Things of Science*. Each month the members receive a scientific surprise package at the cost of only $5 a year, possible only because of our nonprofit operation. Usually there are a half-dozen specimens in each unit. The materials, specimens and equipment contained in *Things of Science* are accompanied by suggested experiments, together with scientific details concerning the manufacture and use of these novel samples. Sometimes these kits introduce to the subscriber a new product; sometimes they show the stages through which a familiar one passes. Over 200 units have been is-

A scene of the exhibit hall of the Ninth National Science Fair, held at Flint, Michigan, on May 7, 8, 9, 10, 1958. More than 30,000 persons saw the exhibits.

sued, and currently 20,000 kits are produced each month.

The Science Service National Science Youth Program, dedicated to the development of science talent among youth, in operation since 1941, is effective, widespread and resultful in acquainting youth with science and technology.

Over 500,000 boys and girls in junior and senior secondary schools participate in over 20,000 science clubs affiliated, at no cost, with Science Clubs of America, sponsored by Science Service. With the basic material furnished, these groups conduct, inspire and encourage science experiments and experience predominantly through the six golden years of pre-college education.

Each March or April, science fairs are organized through encouragement and distribution of "know-how" by Science Service. Science fairs were held in 1958 in about 150 areas in the nation. Some 400,000 youth annually show their science and technology exhibits and projects in these and high school fairs that lead up to the local fairs. As top awards, contestants in these local fairs are sent to the National Science Fair, conducted by Science Service in a different city each May. More than 325 students will attend the 10th National Science Fair in Hartford, Conn., May 6, 7, 8, 9, 1959.

Science fairs are conducted by local organizations that enlist participation of school systems, colleges, industries, newspapers, service clubs, museums, etc. This is a "grass-roots" operation which reaches youth with directness. Good teachers espouse and encourage it. All the science factors in a community can cooperate. The hope is that there will be a science fair available to every interested student. Now, well over half of the nation is covered geographically. State academies of science and other science groups including the National Science Foundation are taking leadership in the movement, cooperating with Science Service.

The annual Science Talent Search for the Westinghouse Science Scholarships and Awards, conducted by Science Service, the 18th of which is now in progress, selects from all the high school seniors of continental United States, those whose scientific skill, talent and ability indicate a potential creative originality.

The Science Talent Search is the pioneering demonstration that successful scientists of the future can be spotted at the high school level. Studies of 40 winners and honorable mentions chosen each year show that they fulfill magnificently their expectations, more than half going on to doctoral degrees. Entrants in 32 states have the opportunity of further recognition in state searches.

The science youth program has become international, with Japan the first country to establish a science fair and send its youthful finalists to our National Science Fair. We foresee a potential expansion of the science youth program to other nations, for the techniques and methods are transferable and adaptable to other peoples and other lands.

The identification of science talent at an early age is important in augmenting the supply of scientists for the future. A new sort of test, called "Science Background" for use by teachers in the upper grades and junior high school has been developed and issued.

One important by-product of popularization is aid to research. Often first news of research results comes to other specialists through a popular channel, particularly if the research happens to be in a different pigeonhole of science. Science Service has lent its aid to research in a number of fields, such as the collection and distribution of cosmic data, the investigation of archaeological discoveries, and the location of earthquake epicenters. It has also pioneered in the development of microphotographic duplication and its application to scholarly research materials. Microfilms make available the contents of libraries and allow the publication of research results that otherwise would not be made available.

Our current development of new techniques for science communication consists of the demonstration that Interlingua, a "natural" auxiliary international language, can be used effectively for overcoming language barriers. It is being used in abstracts in over 20 scientific journals, largely medical, providing international access to the articles since almost anyone can read Interlingua without prior study. Internationally understandable summaries of some seven international congresses have been published in Interlingua.

Books are published from time to time by Science Service, the latest of which is a revision of *The Chemical Elements*, issued in a large run which makes possible a low price (10 for $5.00) for class and club use.

Science Service has pioneered in radio since its early days and we have had a weekly program on CBS since 1930 in which scientists are interviewed.

Tomorrow's opportunities in advancing science understanding are constantly increasing, for the horizon moves ever onward, no matter how rapidly we advance. As a dedication of the present and the future, there can be repeated a statement, portions of which have appeared in the fundamental literature of Science Service kept in print since the foundation of the institution in 1921:

In a democracy like ours it is particularly important that people as a whole should so far as possible understand the aims and achievements of modern science, not only because of the value of such knowledge to themselves, but because research directly or indirectly depends upon popular appreciation of its methods. The specialist is likewise a layman in every science except his own, and he, too, needs to have new things explained to him in nontechnical language. Scientific progress is so rapid and revolutionary these days that no one can keep up with it without some means of maintaining close contact with its new ideas and discoveries.

Biological Programs at AAAS Washington Meeting—*December 26-31, 1958*

THE 125th Meeting of the American Association for the Advancement of Science will include sessions of 18 AAAS sections and some 91 participating organizations. Programs of particular interest to members of the AIBS are:

I. AAAS. Presidential Address on medical genetics by Laurence H. Snyder, followed by reception, Dec. 28 eve. General Symposium—Moving Frontiers of Science III: "Comparative Patterns of Scientific Organization," Dec. 26 eve. and Dec. 27 aft. Speakers: Robert Major, Royal Norwegian Council for Scientific and Industrial Research; E. S. Hiscocks, Director, United Kingdom Scientific Mission; Don K. Price, Vice President, the Ford Foundation; and representatives from Japan and U.S.S.R. AAAS Committee on Social Aspects of Science. Panel, "Perspectives in Our National Medical Research Program," Dec. 27 morning. AAAS Smoker for all registrants, 8:30-11:00 p.m., Dec. 29.

II. AAAS Section F-Zoological Sciences. Vice Presidential Address, "Biology and Politics—Some Thoughts after a Visit to the U.S.S.R.," by Harold H. Plough, at Zoologists Dinner, Dec. 29; Symposium on "Some Unsolved Problems in Biology," jointly with Section G-Botanical Sciences, arranged by Karl M. Wilbur and Barry Commoner, Dec. 30.

III. AAAS Section G-Botanical Sciences. A second symposium, co-sponsored by the Botanical Society of America, and sessions for contributed papers. Vice

Presidential address by Oswald Tippo and Botanists' Dinner, Dec. 29.

IV. AAAS Section O-Agriculture. Four session symposium, "Water and Agriculture," arranged by Roy D. Hockensmith, Dec. 29, 30. Speakers: Edward A. Ackerman, Resources for the Future, Washington, D. C.; Clarence A. Davis, Attorney, Washington, D. C.; Carl B. Brown, Soil Conservation Service, Washington, D. C.; R. L. Nace, U. S. Geological Survey; Bernard Frank, Forest Service; William C. Ackermann, Illinois State Water Survey Division; Howard T. Orville, Beckman and Whitley, Inc., San Carlos, Calif.; C. H. M. Van Bavel, Agricultural Research Service, Raleigh, N. C.; G. L. Barger, U. S. Weather Bureau, Asheville, N. C.; Vincent J. Schaefer, Munitalp Foundation, Inc., Schenectady, N. Y.; Cecil H. Wadleigh, Agricultural Research Service; Herbert C. Storey, Forest Service; Wayne D. Criddle, Utah State Engineer, Salt Lake City; William I. Palmer, Bureau of Reclamation; William G. McGinnies, Central State Forest Experiment Station, Columbus, Ohio; T. W. Edminster, Agricultural Research Service; F. L. Timmons, ARS, Laramie, Wyo.; G. Earl Harbeck, Jr., U. S. Geological Survey, Denver, Colo.; C. B. Tanner, University of Wisconsin; Waldo E. Smith, American Geophysical Union.

American Association of Clinical Chemists. Symposium on "Biochemical Studies in Schizophrenia," arranged by Elizabeth G. Frame, Seymour S. Katy, moderator, and dinner, Dec. 29; contributed papers, Dec. 30.

American Physiological Society. Two-session symposium on Space Medicine, arranged by Fred A. Hitchcock, Dec. 30, 31.

American Society of Naturalists. Symposium on "Integrative Mechanisms in Biology," arranged by Jack Schultz. Speakers: John C. Lilly (nervous system), NIH; Ralph O. Erickson (growth), University of Pennsylvania; Efraim Racker (metabolic cycles), Public Health Research Institute, New York; and Henry Quastler (theoretical considerations), Brookhaven National Laboratory. Dinner and presidential address.

American Society of Zoologists. Three-session symposium on "Vertebrate Morphology," arranged by Alfred S. Romer, Dec. 27, 28; three-session symposium on "Arthropod Physiology," arranged by John B. Buck, Dec. 28, 29; contributed papers on endocrinology, physiology, etc., Dec. 27, 28; business meeting, Dec. 29.

Biometric Society, ENAR. One or more sessions jointly with the American Statistical Association, Dec. 30.

Ecological Society of America. Sessions for contributed papers in plant and animal ecology, possible symposium, arranged by David E. Davis.

National Association of Biology Teachers. National meeting, Dec. 26-30.

Society for Industrial Microbiology. Program arranged by Washington Section and co-sponsored by AIBS. Two-session symposium, "Microbiology in Outer Space," Dec. 28; contributed papers.

Society of Systematic Zoology. A series of symposia: "Basic Concepts of Systematic Order," arranged by Alfred E. Emerson, Dec. 29. Speakers: M. R. Irwin, University of Wisconsin; H. H. Ross, Illinois Natural History Survey; C. H. Seevers, Roosevelt University. Two symposia arranged by George W. Wharton: "Linnaeus," Dec. 28. Speakers: Reed Rollins, Gray Herbarium; W. T. Stearn, British Museum; H. W. Rickett, New York Botanical Garden; R. E. Buchanan, Iowa State College; E. G. Linsley and R. L. Usinger, University of California. "Systematics, Present and Future," Dec. 29. Speakers: Remington Kellogg, U. S. National Museum; F. A. Stafleu, International Bureau for Plant Taxonomy and Nomenclature, Holland; Richard E. Blackwelder, Southern Illinois University; David D. Keck, New York Botanical Garden; G. W. Wharton, University of Maryland. A panel discussion of the London Meeting on Nomenclature, Dec. 30. Session for contributed papers and business meeting. All or parts of the Society's celebration of the Linnaean Bicentennial are co-sponsored by AAAS Sections F and G, American Society of Plant Taxonomists, Association of Southeastern Biologists, Entomological Society of America, Systematic Section and other biological societies.

Closed Circuit Color TV Programs

A special feature of this year's Washington meeting will be a series of sectional programs, essentially teaching demonstrations, employing a new, much-improved technique in closed circuit color television using a large screen. This new research and teaching tool, to be shown for the first time, has been lent by Ciba Pharmaceutical Products, Inc. The program of Section B-Physics, Dec. 27, has been arranged by a committee headed by Deane B. Judd, National Bureau of Standards; the program of Section F-Zoological Sciences and G-Botanical Sciences, Dec. 28, has been arranged by a committee with Burr Roney, University of Houston, chairman. The program committee of Section N's four-session symposium on congenital heart disease plans sessions that will include models, pathologic specimens, differential diagnostic work-up, and a live heart operation by A. Glenn Morrow, National Heart Institute.

The AAAS Annual Exposition of Science and Industry (more than 100 booths) and the **AAAS Science Theatre,** with recent foreign and domestic films, will be prominent features of the meeting. Coupons for sleeping accommodations and advance registration will be found in *Science*, beginning July 18.

The New Edition of the International Code of Botanical Nomenclature

C. V. MORTON, *Curator of Ferns, U. S. National Museum*

THE (December) 1956 edition of the International Code of Botanical Nomenclature,[1] embodying the decisions of the Eighth International Botanical Congress that was held in Paris in July, 1954, was prepared by the Nomenclature Committee appointed by the Congress, consisting of J. Lanjouw, Chairman, C. Baehni, W. Robyns, R. C. Rollins, R. Ross, J. Rousseau, G. M. Schulze, A. C. Smith, R. de Vilmorin, and F. A. Stafleu, Secretary. Now that another International Botanical Congress is imminent (to be held in Montreal, July, 1959), it is appropriate that some comments be made concerning the present Code, which has been insufficiently reviewed in botanical journals.

The new Code, which will undoubtedly be known in the future as the Paris Code, is now a sizeable book of 338 pages, larger because of the greater number of *nomina conservanda* and especially because of the inclusion of translations into German and Spanish as well as English and French, the only languages for the previous Stockholm Code. The desirability of having German and Spanish translations available to the large number of users familiar with these languages is not to be questioned, but the advisability of including them in the official Code is debatable. They increase not

[1] Pp. 1-338. 1956. Obtainable from The International Bureau for Plant Taxonomy and Nomenclature, Lange Nieuwstraat 106, Utrecht, The Netherlands. $7.00 ($3.50 to members of the IAPT).

only the bulk of the book but, naturally, the cost, and this may limit the sale somewhat. The Stockholm Congress decided that English would be the official language of the Code; the official edition might well be English-French only, as in the Stockholm Code. An English-German and English-Spanish edition (and also English-Russian) could well be issued separately; the large part, occupying 81 pages, devoted to the list of conserved generic names could be reproduced in all from the same type. This procedure would doubtless satisfy all users.

The Editorial Committee was given authority by the Paris Congress to reorganize and reword the Code, without changing the meaning. The principal reorganization, definitely authorized by the Congress, was to remove certain of the articles (especially I-XI) from the Rules to a separate division to be titled "General Considerations and Principles." In the published Code the "General Considerations" has been eliminated and the "provisions" incorporated into a "Preamble," a sort of general introduction to the Code. This is logical, for the material is explanatory and advisory rather than regulative.

In the main division (II, the Rules and Recommendations), the chapters have been reorganized. For the first time, the "Notes" are in large type, the same as that of the Article to which they are appended, and this serves to emphasize that the Notes are an integral part of the Rules. The Examples and Recommendations are in smaller type, but this should not be interpreted to minimize the importance of the Recommendations. As pointed out to me long ago by the late Mr. C. A. Weatherby, the Recommendations cover many important points, and one is not really free to follow them or not, as one chooses. It is expected that all authors will follow the Recommendations scrupulously; the difference from the Rules is that the Recommendations are not retroactive, and therefore one may not reject a name or epithet because it is not in accordance with a Recommendation.

The most important, entirely new, provision of the Rules is Article 35, which reads: "Publication on or after 1 Jan. 1958 of the name of a new taxon of recent plants of the rank of order or below is valid only when the nomenclatural type is indicated," and Rec. 35A "When the nomenclatural type of a new taxon is a specimen, the place where it is permanently conserved should be indicated."

This provision for an indication of the type for valid publication might be considered a natural consequence of the type method. Still, the type method would work without it, as indeed it has to, because the majority of plant species existing have already been described without the citation of types. These older names have to be interpreted by choosing lectotypes. The majority of future names will have a cited type, regardless of this provision in the rules, and those that do not could have lectotypes chosen just like the older names. This has been the current practice. The difficulty in having hard and fast rules is that people in general are reluctant to reject names because of what might be considered formal technicalities. An entirely similar requirement is the one requiring Latin descriptions for valid publication. This was ignored by many botanists whose names were so widely accepted that the date for requiring Latin descriptions was moved up to 1935, and even so many names published after that date without Latin diagnoses have been indexed (e.g. in the Gray Card Catalogue) and thus given a certain status. And the algologists still refused to abide by the rule, so much so that a new provision was adopted at Paris making the algae a special exception by validating taxa of algae published without Latin diagnoses up until January 1, 1958. And it remains to be seen if algologists will follow the Code even now. It can confidently be predicted that there will be efforts in the future to get the date set ahead for the requirement for the obligatory indication of the nomenclatural type. And it might well be so, for the requirement is so new that many botanists not especially interested in nomenclature do not know of it yet.

There is a further point in connection with this Article that is not entirely clear. Some names will be validly published, including Latin diagnoses, except for the omission of the citation of the nomenclatural type. Can these names be subsequently validated by another author merely by supplying the citation of the type and referring back to the previous description? Presumably so. But in that case, the question of author citation arises. Is the name still credited to the original author, to the original author "ex" the later publisher of the type citation, or merely the latter alone? Probably most writers will cite the original author only, although the double authority with "ex" is doubtless correct. The case will be similar to those mentioned in Rec. 46A, which specifies that such a name as *Gossypium tomentosum* Nutt. ex Seem. may be cited as *Gossypium tomentosum* Seem. if it is "desirable or necessary to abbreviate it." This is, of course, not a new provision of the Code, but it is one that is very little known, and mostly ignored by general botanists, who get their names from floras in which such names usually appear merely as *G. tomentosum* Nutt. A casual inspection of the names in Fernald's new edition (1950) of Gray's Manual, and of Gleason's New Illustrated Flora, for instance, has failed to reveal a single case where this recommendation has been followed. It is likely that this provision of the Code will continue to be ignored, partly because it goes against historical tradition and general 19th Century usage, and partly because of an instinctive feeling that the original coiner of a name has certain "proprietary" rights regardless of whether he has validly published the name himself or not.

It may be appropriate to mention Rec. 24C (Stockholm 37C), which reads: "Botanists proposing new infraspecific epithets should avoid such as have been used previously for species in the same genus." This recommendation is not new, but it has not been commented on much in nomenclatural discussions and has been very little applied. Naturally, when looking for epithets for new species one goes through the Index Kewensis (or other appropriate index) to see if a certain epithet is preoccupied, but probably very few authors do the same when choosing epithets for varieties and subspecies, as this recommendation advocates. The provision is intended to reduce the chances for confusion, and especially to make it unnecessary to change the epithet when varieties or subspecies are raised to specific rank, which happens not infrequently.

It may be pointed out that Rec. 60A (3) "When an infraspecific taxon is changed in rank within the species, the original epithet should be retained unless the resulting combination is contrary to this Code" is a new one. It is designed to discourage the renaming of varieties when they are promoted to subspecies, or other such changes of rank. This is one of those matters that is properly the subject of a recommendation only. There are many varietal names (and also names of forms) that denote albinos or other freaks, and it is not desirable that these names be adopted as subspecific names merely because of priority. This is one case where a recommendation should be followed normally but not invariably.

The Stockholm Code provided that the subgenus containing the type species of a genus should have the generic name unaltered, e.g. *Lythrum* subg. *Lythrum* rather than subg. *Eulythrum*. This was expanded at Paris to include the section containing the type species also, so that we now have *Alpinia* subg. *Alpinia* sect. *Alpinia* rather than *Alpinia* subg. *Autalpinia* sect. *Hellenia*. The Editorial Committee has further expanded this concept so that all "type" sections of all subgenera bear the subgeneric names unaltered, e.g. *Mouriri* subg. *Taphroxylon* sect. *Taphroxylon* and not *M.* subg. *Taphroxylon* sect. *Acutiflos*. The legality as well as the desirability of the latter change is debatable. Many well-known sectional names will be rendered incorrect.

The Articles dealing with the rejection of names and epithets have been greatly reorganized. The new order is more logical and more easily followed.

The section on orthography has been rewritten competently by Rickett, Sprague, and Pichon. However, it might well be expanded still further by the addition of more examples clarifying debatable points, particularly as to which variations in spelling can be considered orthographic variants and which not. The elimination of umlaut marks, formerly a Recommendation, is now a Rule, and therefore we must now spell an epithet originally published as "Mülleri" as "Muelleri," when it is adopted as a correct name. However, in citing synonyms, the rules continue to recommend that

names be cited exactly as spelled originally.

The former Recommendation to correct an erroneous connecting vowel has now been made a part of the Rule, e.g. *Botrychium matricariaefolium* must now be spelled *B. matricariifolium*, a practice that some of us have been observing all along but many have not. Similarly, an erroneous termination is also treated as an orthographic error that must be corrected, e.g. *Ophioglossum engelmanni* must be written *O. engelmannii* and *Saurauia matudai* as *S. matudae*.[1]

The new Code has now a division giving provisions for modification of the Code, provisions that were omitted from the Stockholm edition. The provisions follow essentially the procedure that was adopted for the Paris Congress. There might well be a provision that matters that are brought up at one Congress and rejected may not be brought up again at the next Congress. It is too bad to spend time debating the same matters over and over again, such as, for instance, those regarding *nomina specifica rejicienda* or the use of initial small or capital letters for certain specific epithets. And it is probably desirable now to have a period of some years when no new nomenclature proposals will be adopted. We need time to determine how well our current Code works before considering modifications, other than in purely minor matters of wording, examples, or additions to the list of *nomina conservanda*.

[1] Some writers appear to think that the genitive termination "-ae" is for the feminine gender only and "-i" for masculines, and that therefore a species named for Mr. Matuda would be *"matudai"*. This is not true either in classical or modern Latin. There are masculines of the first declension, e.g. *nauta, agricola*, and feminines of the second, e.g. *humus, alvus, Quercus*, etc. The Code specifically mentions that the genitive of masculine names ending in "-a" is "-ae". The example quoted is *balansae* from Balansa.

Illinois State Natural History Survey

JAMES S. AYERS, *Technical Editor*

IN OBSERVANCE of the centennial of its founding, the Illinois Natural History Survey will issue late this year an extensive report on its first hundred years of research. The report, written by the Chief, Dr. Harlow B. Mills, and section heads, will cover research relating to economic entomology, applied botany and plant pathology, ecology of wildlife and fish, and taxonomy of the flora and fauna of Illinois.

The Illinois Natural History Survey traces its origin to the Illinois Natural History Society, founded at Bloomington on June 30, 1858. In 1877, most of the functions of the Society and its museum were taken over by the State Laboratory of Natural History, which in 1917 was united with the State Entomologist's Office to form the Natural History Survey.

Since 1885, the main offices and laboratories have been on the University of Illinois campus at Urbana.

Early well-known scientists associated with the organization include Stephen Alfred Forbes, a pioneer ecologist and for many years its head, Benjamin Dann Walsh, entomologist, Robert Ridgway, ornithologist, David Starr Jordan, ichthyologist and university president, and Charles A. Kofoid, limnologist. Forbes' short article, "The Lake as a Microcosm," first published in 1887, is recognized as an early landmark in ecological literature.

As the Illinois Natural History Survey is now organized, its technical research staff is divided into five sections: Economic Entomology, headed by Dr. George C. Decker; Faunistic Surveys and Insect Identification, headed by Dr. Herbert H. Ross; Applied Botany and Plant Pathology, headed by Dr. J. C. Carter; Aquatic Biology, headed by Dr. George W. Bennett; and Wildlife, headed by Dr. Thomas G. Scott. A section of Publications and Public Relations and a Technical Library are also part of the organization. In recent years the staff has averaged about 75 members.

Throughout its century of existence, this state research agency has studied the flora and fauna of the state, and has given particular attention to the life history, classification, and control of important insects.

Notable early studies were on the food habits of fishes and birds, on the ecology and limnology of the Illinois River and smaller streams, on the vegetation of well-defined areas of the state. Later studies were concerned with the stunting of fishes in lakes and ponds, taxonomy of important insect groups, resistance of insects to chemicals, control of the diseases of shade trees and ornamental plants, and population dynamics of waterfowl and upland game birds.

1958 AIBS Governing Board Meeting

A NUMBER of significant actions were taken by the AIBS Governing Board at its annual meeting in Bloomington, August 28. Applications of the Entomological Society of America for full Membership and of the American Society of Agronomy for Affiliate Membership in the AIBS were unanimously accepted.

It was decided that the 1961 annual meetings will be held at some institution in the Midwest and that the 1962 site be either the Rocky Mountain area or the Pacific Northwest. Locations of other future conventions are Pennsylvania State University in 1959, Oklahoma State University in 1960 and the University of Massachusetts in 1963.

The establishment of Advisors to the Governing Board was authorized. These Advisors are to be appointed by the President with the approval of the Governing Board and the number shall not exceed three at any one time.

Following an experimental spring meeting of the Governing Board this year, the Board voted to hold two meetings in 1959. A spring meeting will be held in Washington, and a fall meeting will be scheduled during the Convention period at Pennsylvania State University. The spring meeting will be an executive session of the Board, and the fall meeting will be an open meeting.

Officers for 1959 were elected and are as follows:

President: James G. Dickson, University of Wisconsin

Vice-President: Paul Kramer, Duke University

Secretary-Treasurer: Frank P. Cullinan, U. S. Department of Agriculture

New Member of the Executive Committee for a three-year term: J. M. McGuire, Eli Lilly and Company.

Final action on a proposal to remove the limitation of $1,000 per year dues for an AIBS Member Society was taken. Beginning January 1, 1959, Member Societies will pay dues computed on the basis of $1 per regular member (dues-paying member of the Society) per year. In addition, Affiliate Societies will pay annual dues according to the following schedule:

0 to 999 members—$100 per year
1,000 to 2,999 members—$200 per year
Over 3,000 members—$300 per year

The 1959 budget for the AIBS as approved by the Governing Board follows:

1959 PROPOSED BUDGET AS APPROVED BY THE GOVERNING BOARD

A. INCOME

Dues: Societies, Affiliates, Associates and Individuals		$ 23,700.00
BULLETIN (Exclusive of Program Issue):		
Subscriptions and Miscellaneous	$ 900.00	
Advertising	10,000.00	10,900.00
Business Services		3,300.00
Convention:		
Registration Fees	10,000.00	
Advertising	3,800.00	
Exhibit Hall	6,500.00	
Program Sales	200.00	20,500.00
QUARTERLY REVIEW OF BIOLOGY:		
Subscriptions and Miscellaneous	16,500.00	
Advertising	300.00	16,800.00
Placement Service		400.00
Symposium Proceedings Series		4,950.00
Contract Overhead		50,334.00
Contract Services Committed		326,551.00
Deficit		2,246.00
TOTAL INCOME		$459,681.00

B. EXPENDITURES

Salaries		$ 95,452.00
Taxes		1,000.00
General, including insurance, auditor, attorney, travel (officers, board, staff), telephone, postage, supplies, machine services, maintenance, contingencies, rent		39,620.00
Business Services		1,800.00
Publications:		
Symposium Proceedings Series	$ 750.00	
QUARTERLY REVIEW OF BIOLOGY	12,460.00	
BULLETIN	19,435.00	32,645.00
Placement Service		535.00
Convention:		
Travel	1,200.00	
General Expenses	7,255.00	
Program Issue	5,000.00	13,455.00
Contract Services Committed		273,674.00
Provision for Replacement of Fully Depreciated Capital Equipment		2,500.00
TOTAL EXPENDITURES		$459,631.00

A.I.B.S. Russian Translations

The AIBS is in the process of expanding its Russian Translations Program extensively. Funds to subsidize translation and publication of important Russian literature in biology have been obtained from the National Science Foundation, as part of a larger program to encourage the exchange of scientific information between the two countries. The following monographs have been scheduled for early publication:

Origins of Angiospermous Plants. By A. L. Takhtajan.
Edited by G. Ledyard Stebbins. Translated by Olga H. Gankin.
68 pgs. Ready now. $3.00 (U.S. & Canada) $3.50 (Foreign)

Essays on the Evolutionary Morphology of Plants. By A. L. Takhtajan.
Edited by G. Ledyard Stebbins. Translated by Olga H. Gankin.
Ready early 1959. $5.00 (U.S. & Canada) $5.50 (Foreign)

Problems in the Classification of Antagonists of Actinomycetes. By G. F. Gause.
Edited by David Gottlieb. Translated by Fritz Danga.
Ready early 1959. $5.00 (U.S. & Canada) $5.50 (Foreign)

X-Rays and Plants. By L. P. Breslavets.
Ready early 1959. $5.00 (U.S. & Canada) $5.50 (Foreign)

Arachnida. Vol. IV, No. 2. Fauna of the U.S.S.R. By B. I. Pomerantzev.
Edited by George Anastos. Translated by Alena Eibl.
Ready early 1959. $10.00 (U.S. & Canada) $11.00 (Foreign)

Arachnoidea. Vol. VI, No. 1. Fauna of the U.S.S.R. By A. A. Zachnatkin.
Translated and edited by A. Ratcliffe and A. M. Hughes.
Ready spring 1959. $10.00 (U.S. & Canada) $11.00 (Foreign)

AIBS SPEAKERS BUREAU

ATTENTION!! SMALL LIBERAL ARTS COLLEGES & UNIVERSITIES

VISITING LECTURERS PROGRAM

At present, over 30 prominent biologists have offered their services to the Visiting Lecturers Program. The National Science Foundation has contributed funds to enable these scientists to spend from three to five days on a campus. During this visit, a speaker will be available for classroom lectures, seminars, biology and science study groups, and informal sessions with biology majors. Speakers will also volunteer to address local civic and/or professional groups and other colleges and high schools in the vicinity. Each speaker is an outstanding scientist in his own field and interested as well in the broad aspect of higher education. Not only can biology majors benefit from the personal contacts that such sessions furnish, but undecided students may be stimulated to choose biology as a career.

Speakers available for the 1958-59 academic year are:

Dietrich Bodenstein	Zoology
Lawrence Bolorad	Plant physiology
H. A. Borthwick	Plant physiology
Victor R. Boswell	Horticulture
Frank A. Brown, Jr.	Zoology
John Buck	Physiology
Theodore H. Bullock	Zoology
Herman B. Chase	Animal genetics
Horace W. Davenport	Physiology
Arthur W. Galston	Plant physiology
Eugene B. Hayden	Plant pathology
J. G. Harrar	Plant pathology
Nash Herndon	Medical genetics
James G. Horsfall	Plant pathology
Richard A. Howard	Botany
J. H. Jensen	Plant pathology
Arthur Kelman	Plant pathology
W. D. McElroy	Biology, biochemistry
George L. McNew	Botany, plant pathology
Loren C. Petry	Botany
Ernest C. Pollard	Biophysics
S. R. M. Reynolds	Physiology
Kenneth D. Roeder	Biology
Karl Sax	Botany
J. R. Shay	Plant pathology
William C. Snyder	Plant pathology
E. C. Stakman	Plant pathology
Talbot H. Waterman	Zoology
Charles G. Wilber	General physiology
A. W. Ziegler	Botany

The Atomic Energy Commission has also entered into a contract to supplement the Visiting Lecturers Program with biologists currently employed in AEC laboratories. The Commission is interested in bringing information concerning radiation biology and use of isotopes as research tools to the attention of scientists in all disciplines. There are at present nearly 50 speakers available from the following installations:

Argonne Cancer Research Hospital, Chicago, Ill.
Argonne National Laboratory, Lemont, Ill.
Brookhaven National Laboratory, Upton, L. I., N. Y. (Biology & Medical Depts.)
AEC Project, Univ. of Rochester, Rochester, N. Y.
Donner Laboratory, Univ. of Calif., Berkeley, Calif.
AEC Project, Univ. of Calif., West Los Angeles, Calif.
General Electric Company, Richland, Washington (Hanford Atomic Products Operation)
Oak Ridge National Laboratory, Oak Ridge, Tenn. (Biology Division & Health Physics Division)
Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tenn. (Medical Division)
University of Washington, Seattle, Washington (Applied Fisheries Laboratory)
Western Research University, Cleveland, Ohio (Atomic Energy Medical Research Project)

The AEC speakers will be scheduled, as far as possible, to schools in areas bounding their home states.

All applications for assignments of speakers should be addressed to:

Speakers Bureau
American Institute of Biological Sciences
2000 P Street N. W.
Washington 6, D. C.

Across the Editor's Desk

• **Harvard University has given greater recognition to one of the most rapidly developing branches of science—biophysics**—and will offer a Doctorate for graduate study in the field, beginning in 1959. The degree in biophysics is being offered through the Division of Medical Sciences of the Faculty of Arts and Sciences and the Faculty of Medicine. Although most of the work will be carried on in the Departments of the Medical School at the Longwood Quadrangle in Boston, candidates will also study in the Departments of Physics, Chemistry, Biology and Mathematics and the Division of Engineering and Applied Physics in Cambridge.

• **A revised "Directory of Medical and Biological Research Institutes of the U.S.S.R."** has been issued by the National Institutes of Health, Public Health Service. The new 1958 Directory lists more than 700 institutes with their subdivisions, and includes a general subject and name index. Its purpose is to facilitate the exchange of scientific information between the United States and the U.S.S.R., to provide materials for study of the organization of Russian biomedical research and to assist scientists in planning visits to Russian research centers. The publication of the directories is part of the Russian scientific translation program conducted by the National Institutes of Health. A limited supply of the 1958 edition (PHS Publication No. 587) is available. Requests for single copies should be addressed to the Publications and Reports Section, Scientific Reports Branch, National Institutes of Health, Bethesda 14, Md.

• **A major expansion of research in plant physiology at the California Institute of Technology** has been made possible by a gift of $100,000 from the Campbell Soup Fund. L. A. DuBridge, President of the University, stated that the Campbell gift will enable Caltech to build a new air-conditioned, smog-free greenhouse, including approximately 3,500 square feet of plant-growing area. It will be known as the Campbell Plant Research Laboratory. One-half of the sum donated by the Campbell Soup Fund will be used to match a U. S. Public Health Service grant of $50,000 for construction of the laboratory. The other half will be spent for laboratory equipment.

• The **National Science Foundation has announced 642 grants totaling $12,162,513** awarded during the quarter ending June 30, 1958, for the support of basic research in the sciences, for conferences in support of science, for exchange of scientific information, and for training of science teachers. This is the fourth group of awards to be made during the fiscal year 1958. In the previous quarter ending March 31, 1958, 246 grants totaling $4,720,545 were awarded.

• **The initiation of a new research support program called the Frontiers of Science Foundation of Oklahoma, Inc., has been announced.** Three cash grants totaling $6,800 have been given to scientists located in Oklahoma's smaller colleges and universities. The grants are limited to Oklahoma and to the fields of natural sciences, mathematics, science education and mathematics education. These are the fields of current Foundation interest. It is anticipated that as the Foundation experience with research grants grows, additional fields of research support may be developed. The Frontiers of Science Foundation was organized in October, 1955, as a non-profit association of representatives of business, industry and the professions, to promote broader public understanding of science and mathematics in Oklahoma, to stimulate improvement of education in these fields in the public schools and colleges of Oklahoma, and to improve processes for the location and development of intellectually talented youth within the State. The Foundation offices are located in the Republic Building, Oklahoma City, Oklahoma.

• **The Atomic Energy Commission has accepted 57 scientists and engineers, 50 of them from 18 foreign countries, for enrollment in the eighth session of the Commission's International School of Nuclear Science and Engineering.** The training project, a continuing part of the President's "Atoms-For-Peace" program, is shared by the International School at Argonne National Laboratory, North Carolina State College and Pennsylvania State University. The enrollment brings to 478 the number of scientists and engineers who have participated in the course in unclassified reactor technology.

• **The National Institute of Health, principal research arm of the U. S. Public Health Service, awarded 9,534 grants totaling $136,112,014** for research, training and construction in non-federal institutions during the fiscal year ended June 30, 1958. Detailed information on the year's operations is contained in a 311-page summary released by the Public Health Service—"Public Health Service Grants and Fellowships Awarded by the National Institutes of Health, 1958."

• **Fellowships for study abroad during the 1958-1959 school year have been awarded to 126 outstanding graduate students from thirty-five countries by the Rotary Foundation** of Rotary International, world-wide service club organization. Averaging $2,600, these all-expense fellowship grants total approximately $330,000. Since this program was established in 1947—as a memorial to the founder of Rotary, Paul P. Harris—1,075 young men and women from 65 countries have received Rotary Foundation Fellowships for study in 43 countries. Total grants since 1947 exceed $2,700,000. Rotary Fellowships are unique in that, with some 10,000 Rotary clubs in 110 countries throughout the world, the student is in direct contact with Rotarians and their families wherever he is studying. He attends their Rotary club meetings, visits in their homes and places of business, and travels as much as possible during his holidays. In this way, he sees how the people in his host country live and helps to lay foundations for increased international understanding.

• **A "Bibliography on Medical Electronics,"** prepared by the Medical Electronics Center of the Rockefeller Institute, has been published by the Professional Group on Medical Electronics, Institute of Radio Engineers, 1 East 79th Street, New York 21, N. Y. The "Bibliography" sells for $2.50 per copy and may be obtained from the above address.

• **An increase in stipend rates for research fellowships has been announced by two Federal agencies, the National Science Foundation and the U. S. Public Health Service.** The increased stipends have put into effect the recommendations of senior scientists in training centers throughout the Nation. A survey of these scientists supported this increase as necessary to sustain the productive research training programs of the two Federal agencies. The stipends from both agencies at the predoctoral level will be increased by $200. This will raise the stipend to $1,800 for the first year, $2,000 for the intermediate year, and $2,200 for the terminal year. Predoctoral allowances have been increased to permit $500 for each dependent. Other allowances such as certain travel expenses remain unchanged.

The new stipends for both agencies at the postdoctoral level will be $4,500 for the first year and $5,000 for the second year. In addition, postdoctoral allowances have been increased to provide $500 for each dependent. Other allowances for certain travel expenses and research supplies will remain unchanged.

• **The Atomic Energy Commission has awarded 102 unclassified life science research contracts** in the fields of medicine, biology, environmental sciences, radiation instrumentation and special training. Twenty-eight of the awards, each of which will cover a period of one year, are new projects; 8 in the field of medicine, 13 in biology, 6 in environmental sciences and 1 in special training. The remainder of the contracts are renewals for one more year of previous research.

• **A "Guide to Russian Medical Literature,"** a 90-page source book on Russian literature, has been published by the National Library of Medicine, U. S. Public Health Service. The volume lists 137

important Russian medical journals, reviews 20 Russian journals in the field which are available in complete English translation, and describes sources from which Russian journal literature may be obtained. It also contains a detailed description of available bibliographical sources in English, Russian and other languages on Russian materials in special subject areas. The book was edited by Scott Adams, librarian of the National Institutes of Health, and Frank B. Rogers, Director of the National Library of Medicine. Copies of the publication (Public Health Service Publication No. 602) are available from the Superintendent of Documents, Government Printing Office, Washington, D. C. for 40 cents each.

• **The Division of Medical Sciences of the National Academy of Sciences-National Research Council is accepting applications for grants-in-aid of research or consideration by the Committee for Research in Problems of Sex.** The funds for support of this program are provided by the Rockefeller Foundation and the Ford Foundation. The Committee is concerned primarily with encouraging research on the mechanisms underlying sexual behavior, with special emphasis on the higher mammals and man. Proposals involving endocrinological, neurological, psychological, anthropological, phylogenetic, and genetic studies directed toward this objective are therefore invited. Requests that deal with the physiology of reproduction or with related biological and biochemical fields should be addressed to the Committee only if they give promise of shedding light upon behavioral mechanisms.

Preliminary inquiries should be addressed to Room 411, Division of Medical Sciences, National Academy of Sciences-National Research Council, 2101 Constitution Avenue, N.W., Washington 25, D. C. Completed applications for the fiscal year 1959-1960 should be postmarked on or before January 15, 1959.

• **Applications are invited for the second annual Turtox Scholarship established by General Biological Supply House, Inc.** The stipend of the scholarship is $5,000. Eligible for consideration for this award is any citizen of the U. S. A. who is currently, or who has been, enrolled in a graduate school and who is, or is contemplating, continuing study for the doctorate degree in botany, zoology or biology. The award will be based upon evidence bearing upon the promise of the applicant as a prospective teacher and research scholar. The last date for receiving applications will be February 1, 1959. Application blanks may be requested from the Chairman of the Award Committee, Professor Frank A. Brown, Jr., Department of Biological Sciences, Northwestern University, Evanston, Ill.

• **The Virginia Fisheries Laboratory has announced vacancies for several graduate assistants** desiring to qualify for the M. A. degree in Marine Biology at the College of William and Mary. Qualified candidates will take up residence at the Laboratory and will be eligible for monthly stipends of $125 for half-time work as research assistants to staff members. Quarters are available at nominal cost. For further details write the Director, Virginia Fisheries Laboratory, Gloucester Point, Virginia.

• **The Beaudette Foundation for Biological Research** has recently been activated at Solvang, near Santa Barbara, Calif., with E. Yale Dawson as research director. Several projects on benthic marine botany of the tropical and subtropical eastern Pacific are included in the initial work of the Foundation.

• **The Division of Biological and Medical Sciences of the National Science Foundation announces that the next closing date for receipt of basic research proposals in the Life Sciences is January 15, 1959.** Proposals received prior to that date will be reviewed at the spring meetings of the Foundation's Advisory Panels and disposition will be made approximately four months following the closing date. Proposals received after the January 15, 1959, closing date will be reviewed following the spring closing date of May 15, 1959. Inquiries should be addressed to the National Science Foundation, Washington 25, D. C.

• **The Lalor Foundation has announced its program of awards for 1959** to support research in the fundamental biochemical and biophysical mechanisms concerned with fertility and reproduction in various forms of life. The awards are open to college and university faculty members for research in these fields. Grants range up to $8,000 per year and will be scaled in proportion to the scope and duration of the projects approved. Preference will be given to younger members of university and college staffs with an upper age limit of 45 years. The work may be carried out at the applicant's own institution or elsewhere. Applications and inquiries should be directed to the Lalor Foundation, 4400 Lancaster Pike, Wilmington 5, Delaware. The deadline date for receipt of applications is January 15, 1959.

The Foundation will also grant postdoctorate summer or short-term research awards in the field described on projects which, for example, would be appropriate to the Marine Biological Laboratory at Woods Hole, Mass., or elsewhere. For these awards, the stipend will not normally exceed $900 for a single man or woman, $1,100 for a married man working at his home institution and $1,250 for a married man with a principal program at another institution. Applications for the summer or short-term projects should also be directed to the above address.

• **The AAAS-Campbell Award for Vegetable Research,** supported by the Campbell Soup Company, is open for nomination. The award consists of $1,500, a bronze medal, and expenses to attend the AAAS meetings. It is given for an outstanding single research contribution, of either fundamental or practical significance relative to the production of vegetables including mushrooms, for processing purposes. Food technology and food processing are not included. The one or more papers reporting the research should have been published, or the manuscripts accepted for publication, during 1957 or 1958. Review papers, in general, do not qualify unless the author's original research on the subject is made clear. The recipient for this year will be announced at the AAAS meeting to be held in Washington, D. C., December 30. In view of the limited amount of time, nominations should reach the committee by November 3; they cannot be considered for this year's award if received later than December 2. Wherever possible, seven copies of the papers or manuscripts to be judged, a biographical sketch of the author or authors, and a list of related papers by the authors should be included. Nominations should be sent to: Louis P. Reitz, Chairman of the Award Committee, Agricultural Research Service, U.S.D.A., Plant Industry Station, Beltsville, Md.

• **The United States Finance Committee of the Genetics Society of America wishes to acknowledge with gratitude the following donors to a fund of more than $60,000 which was raised for the travel support of overseas geneticists to the Xth International Congress of Genetics,** held at McGill University, Montreal, Canada, August 20-27, 1958: American Cancer Society, American Cyanamid, Inc., Amherst College, Anonymous, David Bonner, California Institute of Technology, Carworth Farms, Catholic University of America, Arnold Clark, Columbia University, Connecticut Agricultural Experimental Station, DeKalb Agricultural Association, B. O. Dodge, W. F. Dunning and Meynie R. Curtis, DuPont de Nemours, Inc., Eli Lilly, Inc., Fordham University, Genetics Society of America, Earl Green, Jackson Memorial Laboratory, Johns Hopkins University, King Ranch, Manhattan College, National Science Foundation, New York State College of Medicine, Nichols, Inc., North Carolina State Agricultural Experimental Station, Ortho Foundation, Paymaster Farms, Chas. Pfizer & Co., Pioneer Hi-bred Seed Co., Population Council, Public Health Service, Rancho Santa Ana Botanic Gardens, Rockefeller Foundation, Rockefeller Institute, J. Paul Scott, Searle & Co., American Society for Horticultural Science, Society for the Study of Evolution, Tulane University, U.N.E.S.C.O., University of Maryland, University of Pennsylvania, University of Texas, Upjohn Co., E. Peter Volpe, Milton Fingerman, Jerome O. Krivanek, Wesleyan University.

• **The National Science Foundation has announced the award of 34 fellow-**

ships for advanced study and research in the sciences in the Foundation's Regular Postdoctoral Fellowship Program. These fellowships are in addition to the 1,270 fellowships awarded by the Foundation in the spring of 1958.

• **A conference on "Vertebrate Speciation" was held at the University of Texas,** October 27-31, as part of the observance of the 75th anniversary of the University. Speakers and subjects included: *Isolation Mechanisms*, Caryl P. Haskins, John A. Moore, Charles G. Sibley; *Evolution of Behavior*, Peter Marler, John A. King, L. T. Evans; *Polymorphism and Polytypic Species*, E. Peter Volpe, W. F. Pyburn, Keith Dixon, R. F. Inger, J. K. Doutt; *Population Dynamics*, W. W. Milstead, Henry S. Fitch, Victor C. Twitty; *Age and Origin of Species*, Gunnar Svardson, M. J. Littlejohn, R. R. Miller, Curt Kosswig and E. S. Deevey. Persons wishing further information should contact: W. Frank Blair, Department of Zoology, University of Texas, Austin 12, Texas.

• **The Eleventh Annual Conference on Electrical Techniques in Medicine and Biology** was held in Minneapolis, Minn., November 19-21. These annual conferences are sponsored jointly by the American Institute of Electrical Engineers, the Institute of Radio Engineers and the Instrument Society of America. Further information about the conference or the papers presented may be obtained from Otto H. Schmitt, Department of Physics, University of Minnesota, Minneapolis, Minn.

• **The charter meeting of the Laboratory Animal Breeders Association will be held December 2 at the Hamilton Hotel, Chicago, Ill.** This meeting will be just prior to the Animal Care Panel meeting which will commence December 3. Invited to the meeting of the new Association are those individuals who produce laboratory animals for commercial purposes. The agenda will include the nomination and election of officers, voting in of the constitution and by-laws and general discussion. Several papers of direct interest to producers will be offered in the afternoon. Dr. W. T. S. Thorp, Dean, College of Veterinary Medicine, University of Minnesota and Mr. Berton F. Hill, Executive Secretary, Institute of Laboratory Animal Resources, National Academy of Sciences, Washington, will each give a talk generally outlining areas in which the L.A.B.A. can serve to aid the functions of research with benefit both to the producer and the investigator.

• **The "Index of the Japanese Journal of Genetics"** Vol. I (1921)—Vol. XXX (1955) is now available from the Japanese Society for the Promotion of Science, Tokyo, Japan. The publication appeared in 1956, contains 331 pages and costs $2.25. The publication is in both English and Japanese.

• **"A Selected Bibliography of Research and Development and Its Impact on the Economy"** has been prepared by the Office of Special Studies of the National Science Foundation. The Bibliography contains over 400 items and may be obtained from this Office of the Foundation.

• **The Office of Naval Research is currently engaged in a program which is ultimately aimed toward making available to academic, industrial and governmental scientists a manned balloon-borne laboratory,** 20 to 30 miles above the earth for the purposes of research, environmental testing, and systems experimentation. Three ONR stratospheric flights, employing a 2 man crew within a sealed gondola, have demonstrated the technical and economic feasibility of the Strato-Lab concept. Prior to initiating the construction of a fully instrumented research vehicle, however, ONR has decided to sponsor a study divided into the following three phases: 1) Research Objectives: To determine comprehensively what research objectives such a laboratory might serve and roughly what the relative significance of these objectives might be; 2) Functional Requirements: To state the requirements for the Strato-Lab stemming from each of the research objectives considered. What equipment would have to be carried? What would it weigh? What structural requirements would it impose? etc.; 3) Specifications: Specifications and designs necessary to provide for the needs of various research workers.

In the fields of medical, biological and psychological sciences the Strato-Lab could play a role in 1) the effects of the environment on animals, 2) exploration of the distribution of spores, etc., in the stratosphere.

It is the opinion of ONR that the areas of Phase I are so broad and diversified that no single organization can fully explore them; rather, the scientific community as a whole must be asked to assist in planning a program of research for the Strato-Lab. Accordingly, ONR is putting these questions before the scientific community: Would a manned balloon-borne stratospheric laboratory assist or further research and development in your field of activities? How? What functional requirements, i.e., stability, weight, etc., would these activities impose on the Strato-Lab? It is the intention of the group concerned to hold a symposium in January, 1959, under the sponsorship of ONR, where papers will be invited on subjects chosen from ideas submitted in response to the foregoing request. It is intended that the published proceedings of this symposium will achieve wide distribution and thereby serve to maintain a continuing interest in the Strato-Lab project. Anyone wishing to make suggestions in connection with this project should address them to: J. J. Freeman, Vitro Laboratories, 14000 Georgia Avenue, Silver Spring, Md.

• **The Special Library Association's Translation Center, located at the John Crerar Library in Chicago, has announced that it can now furnish on a subscription basis printed catalog cards for current scientific and technical material which has been translated into English from all languages including Russian.** Partially supported by grants from the National Science Foundation and the National Institutes of Health, the SLA Translation Center is a depository for unpublished scientific material which has been translated into English. It solicits and collects translations from Government agencies, industry, technical societies and educational institutions, and makes copies of these translations available to other research groups and individuals. Users may borrow paper copies of desired translations or may purchase for permanent retention microfilm or photoprint. At the request of the National Science Foundation, the SLA Translation Center took over, in January, 1958, the Russian Translations then housed in the Scientific Translation Center at the Library of Congress. This added 4,000 Russian items to the collection, and since then Russian material has been received regularly about 3,000 titles a year. Further information about this service may be obtained from: SLA Translation Center, John Crerar Library, 86 Randolph Street, Chicago 1, Ill.

• **The American Tobacco Company Research Laboratory,** Richmond, Va., recently received the Virginia Academy of Sciences Distinguished Service Award as "international leader in tobacco research, befriender of science in community affairs, and outstanding contributor to the advancement of science in America."

• **The International Commission on Zoological Nomenclature** has moved to new headquarters in London. All correspondence and inquiries should now be addressed to: Mr. R. V. Melville, Assistant Secretary, International Commission on Zoological Nomenclature, 119 Parkway, Gloucester Gate, London, N.W. 1, England.

• **Certain educational expenses incurred by teachers (college, high school and elementary) in the United States may be deducted from income tax and portions recovered for the years going back to 1955.** This is the result of U. S. Treasury Regulation PD6291, as published in the Federal Register for April 5. In submitting an amended return, the taxpayer must use the appropriate income tax form for the years returned and write across the top of Page 1 "Amended." He must also resubmit the return in complete detail. While many aspects of the new ruling will be interpreted by the Treasury, the text as it appears offers nine cases as specific examples.

• **A Foreign Technical Information Center** is now operating in the U. S. Department of Commerce to provide American science and industry with access to translations including a large amount of U.S.S.R. technical information. The services of the new center include publication of abstracts of all articles appearing in 141 Soviet technical journals, translations of important sections of *Referapivnyi Zhurnal*, and a semi-monthly review of various areas of Soviet science compiled by the Central Intelligence Agency. Abstracts of each issue of the 141 journals may be purchased from OTS on a subscription or single-issue basis, as may CIA's *Scientific Information Report*. The various sections of *Referapivnyi Zhurnal* will be sold initially by single issues, but subscription sales may be offered later. The Office of Technical Services, directed by John C. Green, will soon begin distributing complete translations of articles and books. These translations will be listed in an abstract journal that will begin publication this fall. Congress appropriated $510,000 for the operation of this program in fiscal 1959.

• **The American Association of University Women has announced 40 fellowships open to women in 1959-60.** These fellowships are offered to women who already hold a doctorate and to women who have completed all requirements for the doctorate except the dissertation. They are unrestricted as to field and place of study, except that one is specified as post-doctoral in the field of physics, chemistry or biology. Stipends range from $2,000-$4,000. Application forms may be obtained from: The Director, AAUW Fellowship Program, 1634 I St., N.W., Washington 6, D. C. Deadline for applications is December 1st and successful candidates will be notified by March 1, 1959.

• **The American Type Culture Collection has announced the sixth edition of its Catalog of Cultures.** This catalog lists 4,350 strains of microorganisms, including bacteria, bacteriaphages, filamentous fungae and yeast, algae and protozoa. Previous editions of this catalog have been subsidized by the Society of American Bacteriologists and have been distributed without charge. Upon recommendation of the several biological societies that sponsor ATCC, a policy has now been adopted of making a nominal charge of $1.00 (postpaid). It is expected that this will result in keeping the catalog revisions more nearly current. The present revision is the first since 1949. Orders for the catalog should be sent to: The American Type Culture Collection, 2112 M Street, N.W., Washington 7, D. C.

• **60,000 pages of Soviet scientific and technical journals are now available in English to U. S. scientists and engineers according to a recent publication of the National Science Foundation.** This compilation shows that there are now in print 53 English editions of Russian journals, 4 extensive series of translated Russian abstracts and 4 series of partial translations of Russian journals. Support for the translations is provided by the National Science Foundation, the National Institutes of Health, the Office of Naval Research and Atomic Energy Commission, and by six commercial translating and publishing firms working without Government funds. The new NSF compilation gives a complete list of translated journals, information on the source of financial support if any, the names and addresses of the publishers and the annual subscription prices.

• ***Trieste*, the Bathyscaphe designed and launched by Auguste Piccard and his son Jacques in 1953, has been purchased by the U. S. Navy for $200,000.** The *Trieste* has already been taken down in the sea to almost 3 miles, or twenty times deeper than conventional submarines. Sometime this fall, *Trieste* will begin diving off San Diego, California, to study the ocean's physical biological, geological and chemical characteristics.

• **Natural Science Supplies** is a newly formed organization in Australia that offers to provide collections of Australian specimens, both mounted or unmounted, generally identified. The organization has been formed by M. I. Nikitin, Ph.D., entomologist, with 25 years of experience in Manchuria and Australia, and Frank L. Edwards, an Australian journalist. With the assistance of scientists in local universities, museums and government departments, they believe that they can render an efficient collecting service. Particularly suitable would be requests for the unique fauna and flora that is endemic to that continent. The owners also offer to supply schools and art galleries with specially prepared biological or artistic material. Inquiries about Natural Science Supplies should be addressed to: 84 Camden St., Fairfield, Sydney, New South Wales, Australia.

• The second issue of the **Index to Plant Chromosome Numbers,** compiled from nearly 300 journals published in 1957, is now ready for distribution. There are around 2000 listings of original chromosome counts from the entire plant kingdom and a bibliography of 196 papers from which the listings were taken. Preparation of the Index has been supported in part by a grant from the National Science Foundation. The price of each issue is $1.00. Orders for subscriptions should be sent to: Dr. C. Ritchie Bell, Department of Botany, University of North Carolina, Chapel Hill, N. C.

• **The following notice was recently received from the Department of Biology, St. Mary's University, Halifax, N. S., Canada:** Small university is initiating courses in Biology and would be most grateful for donations of duplicate or unused charts, models, slides, museum specimens, or any other equipment which could be of use in the teaching of biology. For further information, contact Dr. Hubert C. Soltan.

• **George Gaylord Simpson,** American Museum of Natural History, was recently elected a foreign member of the Royal Society of England for his distinguished contributions to paleontology and evolution.

• **J. Brachet,** Free University of Brussels, Belgium, received the 1957 Leopold Mayer Prize of the Société de Chimie Biologique (France). The 500,000 franc prize given for research in nuclear proteins, was awarded for the third time when received by Dr. Brachet.

• **A. W. Schorger,** emeritus professor of wildlife management at the University of Wisconsin, has been awarded the William Brewster Medal of the American Ornithologists Union for his book "The Passenger Pigeon—Its Natural History and Extinction." The Medal is awarded once each year for outstanding work in the field of ornithology. Schorger's book published in 1955 by the University of Wisconsin Press, traces the habits, history, behavior and slaughter of the passenger pigeon.

• **Harve J. Carlson** has been appointed head of the Microbiology Branch, Office of Naval Research, Washington, D. C. Dr. Carlson recently returned from a tour of duty with ONR in London, where he served as Scientific Liaison Officer.

• **B. Frank Heintzleman,** Juneau, Alaska, has been awarded the Sir William Schlich Memorial Medal for distinguished service to forestry. The medal was presented at the 58th annual meeting of the Society of American Foresters in Salt Lake City, October, 1958. Governor of Alaska during the period 1953-56, Mr. Heintzleman was previously for 16 years regional forester in Alaska for the U. S. Forest Service.

Nicholas T. Mirov, California Forest and Range Experiment Station, Berkeley, received a second award of the Society of American Foresters consisting of an engraved plaque and a cash honorarium for outstanding achievement in biological research contributing to the advancement of forestry. Dr. Mirov's research project was an investigation of the resinous substance of 80 species of pine trees.

• **Philip B. Dowden,** U. S. Forest Service entomologist, has been appointed technical advisor to the Federal forest insect biological control program in the Northeast. Mr. Dowden will continue to be stationed at the Northeastern Forest Experiment Station's Forest Insect Laboratory at New Haven, Conn.

• **A. Baird Hastings,** for the past 23 years with the Biochemistry Department of Harvard University, retires Dec. 31,

1958, to become Hamilton Kuhn Professor of Biological Chemistry, Emeritus. In January, Dr. Hastings plans to join the Scripps Clinic and Research Foundation at La Jolla, Calif., as a member of the resident research staff.

• **Rolla M. Tyron,** formerly of the Missouri Botanical Garden, was appointed Associate Curator and Curator of Ferns at the Gray Herbarium of Harvard University, effective July, 1958.

• **David D. Keck,** Assistant Director and Head Curator of the New York Botanical Garden, is on a year's leave of absence beginning October, 1958, to be program director for systematic biology, National Science Foundation. During Dr. Keck's leave of absence, **H. W. Rickett,** Bibliographer, will serve as Acting Assistant Director of the Garden, and **Bassett Maguire,** Curator and Coordinator of Tropical Research, will serve as Acting Head Curator.

• **J. P. Nitsch,** Cornell University, has been appointed Associate Director of the new French "Phytotron" which is currently being built about fifteen miles south of Paris. The new Phytotron, when completed, will be the largest in the world. It comprises not only air-conditioned rooms in which all the climates of the world can be produced, but also laboratories in which biochemical research may be carried on. The new French center for Research in Photosynthesis is being built adjacent to the Phytotron. Nearby, the Center for Studies in Genetics and the Center for Studies in Pharmaceutical Plant Substances offer additional facilities for any worker who wishes to spend research time at the Phytotron. Dr. Nitsch's address will be Laboratoire du Phytotron, Gif-sur-Yvette (S. & O.), France.

• **H. F. Robinson** has been appointed head of the newly organized Department of Genetics at North Carolina State College. The department will consist of the genetics faculty previously administered in the Division of Biological Science and the quantitative geneticists in the Institute of Statistics and the Department of Experimental Statistics. In addition to the expansion of the research and teaching functions within the Department of Genetics, emphasis will be devoted to coordinating the work with genetics in other departments. Twenty-two geneticists in the applied breeding fields are associate members of the new department. **S. G. Stephens,** previously in charge of the genetics faculty, has been awarded a Guggenheim travel grant to collect and study species in Central America.

• **William Randolph Taylor,** Department of Botany, University of Michigan, has been elected a foreign corresponding member of the Institut de France, Academie des Sciences, as of June, 1958.

• **Gordon Alexander,** head of the Department of Biology, University of Colorado since 1939, has relinquished all administrative work to devote full time to teaching and research. As of July 1, 1958, the Department has been administered under the chairmanship plan, and **Newell Younggren,** assistant professor, has been elected chairman for a term of three years. **Douglas Kelly,** of Stanford University, joined the Department as instructor at the beginning of the fall semester.

• **Ross A. McFarland** has been named professor of Environmental Health and Safety in the new Division of Environmental Hygiene in the Harvard School of Public Health. He continues as Director of the Guggenheim Center for Aviation Health and Safety.

• **Frits W. Went,** Director of the Earhart Plant Laboratory and professor of biology, California Institute of Technology, Pasadena, has been appointed director of the Missouri Botanical Garden, St. Louis. **Hugh Cutler,** who has been acting director of the Garden since December, 1956, has been appointed executive director.

• **Loren D. Potter,** Botany Department, North Dakota State College, has been named chairman of the Biology Department, University of New Mexico, Albuquerque, effective September, 1958.

• **Findlay E. Russell,** director of the Laboratory of Neurological Research, Los Angeles County General Hospital, has returned from a three-month study at the Marine Biological Laboratory of the United Kingdom in Plymouth, England.

• **Nicholas T. Mirov,** California Forest and Range Experiment Station, U. S. Forest Service, Berkeley, received at the U.S.D.A. ceremonies held at Washington, D. C. May 27, the Distinguished Service Award, which consisted of a gold medal and a diploma. The citation was "for outstanding initiative, creative scientific contributions, distinguished authorship and worldwide recognition in conceiving and conducting fundamental research into the physiology of forest trees and chemistry of pine turpentines."

• **Henry Kritzler** has been appointed Resident Naturalist at the Lerner Marine Laboratory, Bimini, Bahamas, B.W.I. Dr. Kritzler will assume duties there in December, 1958.

• **H. Burr Steinbach,** chairman of the Department of Zoology, University of Chicago, has been appointed chairman of the Division of Biology and Agriculture of the National Academy of Sciences—National Research Council. As chairman, Dr. Steinbach will guide the Division's activities in bringing together distinguished scientists from government, industry and universities to deal with broad scientific problems facing biologists and the community at large.

• **S. M. Dietz** has retired from the administrative duties as chairman of the Department of Botany, head of Botany and Plant Pathology, and administrator of the Herbarium at Oregon State College, effective June, 1958. Dr. Dietz will continue teaching and research. **Roy A. Young** assumed all administrative responsibilities July, 1958.

• **Wayne C. Hall,** professor of plant physiology, has been appointed head of the Department of Plant Physiology and Pathology at Texas A. & M. College, replacing **G. M. Watkins** who became Dean of the School of Agriculture.

• **James S. Bowman,** formerly entomologist with the Army Chemical Center, has joined the staff of Hazelton Laboratories in Falls Church, Va. Under Dr. Bowman's guidance, the 90-acre experimental farm Hazelton Laboratories maintains for biological and chemical research will be expanded to include studies of plant disease and insect life.

• **Melbourne R. Carriker,** associate professor of zoology, University of North Carolina and Secretary of the Executive Committee, University of North Carolina Institute of Fisheries Research, completed an extensive visit to the British Isles during the past summer. Besides attending the XVth International Zoological Congress in London, he visited malacologists at Burnham-on-Crouch and Plymouth, England; Millport, Scotland; and Menai Bridge and Conway, Wales.

• **Roy C. Wiggans,** Department of Plant Breeding, Cornell University, retired in June, 1958, after more than 40 years of service in plant breeding and field crop production. He is well known for the early, adapted hybrid varieties of field corn which he has developed for New York and adjacent areas of the Northeast.

• **Roger Tory Peterson,** naturalist and author, has been awarded the St. Hilaire Golden Medal of the Société Nationale d'Acclimation et de Protection le la Nature for "his wonderful work in the field of science, education and nature conservation, especially bird protection."

• **Rae Whitney,** assistant research professor and director of the Mammalian Genetics and Breeding Laboratory, Boston University, has joined Bio-Research Institute, Inc. and Bio-Research Consultants, Cambridge, Mass., as biologist and director of animal production.

• **Graham DuShane,** editor of *Science,* recently received an honorary degree from Wabash College.

• **Linus Pauling** has resigned as chairman of the Division of Chemistry and Chemical Engineering, California Institute of Technology, after 21 years in the

post, Dr. Pauling is succeeded in the chairmanship by **Ernest H. Swift,** a leading American analytical chemist and a member of the faculty for 38 years. Dr. Pauling will continue at the Institute as Professor of Chemistry.

• **William Montagna,** professor of biology and head of the department, Brown University, has been selected by the Colgate-Palmolive Company to receive an award of $5,500 in recognition of his research contributions in the field of skin and hair biology. The award will asist Dr. Montagna in his current research on the skin of primates.

• **Detlev W. Bronk** and **Linus C. Pauling,** earlier this year, were awarded membership in the Soviet Academy of Science. They were among the first group of non-Soviet citizens to be so honored. Dr. Bronk is President of the National Academy of Sciences and of the Rockefeller Institute of Medical Research. Dr. Pauling is Nobel Laureate and professor of chemistry at the California Institute of Technology.

• **Selman A. Waksman,** director of the Rutgers Institute of Microbiology, retired recently. He was succeeded in the post by **J. Oliver Lampen** who had been director of the Division of Biochemical Research at the Squibb Institute for Medical Research.

• **Frederic S. Orcutt,** professor of bacteriology, has been named acting head of the Biology Department at the Virginia Polytechnic Institute. He succeeds **I. D. Wilson** who recently retired after nearly 35 years as head of the Department.

• **Larkin H. Farinholt** has been appointed Deputy Science Advisor in the Department of State. Dr. Farinholt has been a member of the Chemistry faculty at Columbia University since 1947.

• **Charles W. Buggs,** professor of microbiology, Howard University College of Medicine, Washington, D. C., was appointed chairman of the Department of Microbiology, July, 1958.

• **Richmond K. Anderson,** associate director for biological sciences, Rockefeller Foundation, was the recent recipient of an honorary degree from Harvard University.

• **Paul B. Sears,** chairman of the Conservation Program, Yale University, received an honorary degree at the spring commencement of Oberlin College.

• **H. O. Henderson,** professor of dairy husbandry, West Virginia University, received a $1,000 teaching award in dairy production of the National Dairy Products Corporation at the 53rd annual meeting of the American Dairy Science Association.

• **Ruth Wallace,** geneticist at the Biological Laboratory, Cold Spring Harbor, has been named associate professor in the Department of Plant Breeding, Cornell University, as of September, 1958.

• **James A. Oliver** has been appointed director of the Bronx Zoo. Since April, 1958, he has been assistant director and since 1951, curator of reptiles.

• **James G. Horsfall,** director of the Connecticut Agricultural Experiment Station, received an honorary degree from the University of Vermont during spring commencement.

• **Sewall Wright,** professor of zoology, University of Wisconsin, was a recent recipient of an honorary degree from Western Reserve University.

• **John J. Biesele** has joined the University of Texas as professor of zoology. Dr. Biesele was formerly with the Sloan-Kettering Institute for Cancer Research in New York.

• **John B. Storer,** Biomedical Research Group at the Los Alamos Scientific Laboratory, has joined the research staff of the Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine.

• **Aaron Novick** has been appointed professor of biology and Director of the new Institute of Molecular Biology at the University of Oregon, Eugene, effective January, 1959. Dr. Novick was formerly associate professor of microbiology at the University of Chicago.

• **Paul K. Stumpf,** professor of plant biochemistry, University of California, Berkeley, has moved to the Davis campus to assume chairmanship of the new Department of Agricultural Biochemistry.

Eric E. Conn, also of Berkeley, has accepted the position of associate professor of Plant Biochemistry in the new Department.

• **Raymund L. Zwemer** recently joined the staff of the Science Advisor in the Department of State. Dr. Zwemer has been in Paris for the past two years with UNESCO as Chief of the Division of International Cooperation for Scientific Research. Dr. Zwemer's new position in the Office of the Scientific Advisor will involve work with the science programs of inter-governmental organizations, both international and regional.

• **Howard Boroughs** has joined the staff of the Inter-American Institute of Agricultural Sciences, Turrialba, Costa Rica, where a new laboratory for research and training in the use of radioisotopes in agriculture for Latin American countries has been formed. Dr. Boroughs was formerly with the Atomic Energy Commission Project at the Hawaii Marine Laboratory.

• **Roger B. Friend,** formerly Chief Entomologist and Vice-Director of the Connecticut Agricultural Experiment Station, has retired after 34 years on the Station's staff.

• **E. Yale Dawson,** associate professor of biology, Alan Hancock Foundation, has been appointed Research Director of the newly established Beaudette Foundation for Biological Research at Solvang, Calif.

• **Kimball C. Atwood** of the Biology Division of the Oak Ridge National Laboratory, Oak Ridge, Tenn., has been named to head the work in medical genetics at the University of Chicago.

• **Bernard M. Fry** was recently named deputy head of the Office of Scientific Information at the National Science Foundation. Dr. Fry was formerly with the Atomic Energy Commission as assistant director for Technical Information and chief of the AEC Technical Information Service.

• **Anthony C. Clement,** Emory University professor of biology, has been named Program Director for Developmental Biology, Division of Biological and Medicine Sciences, National Science Foundation. Dr. Clement is on a year's leave of absence.

• **Gilbert L. Stout,** chief of the Bureau of Plant Pathology, California Department of Agriculture, recently received an honorary degree from Miami University.

• **Donald B. McMullen,** chief, the Department of Medical Zoology for the Walter Reed Army Institute of Research, will work with the World Health Organization for fifteen months as epidemiologist on a two-man team that will undertake a study of methods for the prevention of schistisomiasis in hydroelectric irrigation and drainage problems in the Middle East and Africa.

• **A. C. Smith** has been appointed director of the Museum of National History of the U. S. Museum, Washington, D. C. Dr. Smith was Program Director for Systematic Biology at the National Science Foundation. Prior to his recent affiliation with NSF, he was for eight years Curator of the Division of Phanerogams in the Smithsonian's Department of Botany.

• **T. William Schneider,** professor of horticulture at North Carolina State College, has accepted the appointment as chairman of the Horticulture Department at the University of Kentucky.

• **Herbert B. Hungerford,** professor emeritus of entomology at the University of Kansas, has been awarded the Leidy Medal of the Academy of Natural Sciences of Philadelphia. The Medal, presented every three years, is for the "best publication, exploration, discovery or research in the natural sciences."

• **Paul B. Pearson,** chief of the Biology Branch of the Atomic Energy Commission and a professor at Johns Hopkins University, has been named an associate in the program in Science and Engineering at the Ford Foundation.

• **George W. Beadle,** professor of biology and Chairman of the Division of Biology at the California Institute of Technology, has been appointed a trustee of Pomona College, Calif.

• **Olga Lakela** has retired after fifteen years as professor of botany and curator of the herbarium at the Duluth State Teachers College and the Duluth Branch of the University of Minnesota.

• **Laurence H. Snyder,** President of the University of Hawaii, has been named President of the Tenth Pacific Science Congress to be held in Honolulu in 1961.

• For outstanding basic research in the area of poultry science, **George M. Briggs,** Chief of the NIAMD Nutrition Unit, National Institutes of Health, was recently awarded the 1958 Borden Award in Poultry Science, consisting of a gold medal and $1,000. The presentation was made at the 50th anniversary meeting of the Poultry Science Association.

• **James D. Watson,** an authority on the nucleic acids related to the chemistry of inheritance and on the biology of viruses, has been appointed to the faculty of Harvard University. With F. H. C. Crick of Cambridge University, Dr. Watson proposed a model for the structure of the DNA molecule.

• **Edward O. Wilson,** a student of evolutionary zoology and an authority on social behavior and speciation among insects, has also been appointed to the faculty of Harvard University.

• **Dorothy Price** was named professor of zoology at the University of Chicago, effective July, 1958. Dr. Price's major research interest has been the interrelationship of hormones in the growth, development and differentiation of the male and female reproduction tract.

• **Daniel L. Leedy** was the recipient of an American Motors Conservation Award of $500 and a bronze plaque at the annual meeting of the American Society of Mammalogists held in June at the University of Arizona, Tucson. Dr. Leedy, chief of the Division of Wildlife Research of the U. S. Fish and Wildlife Service, was honored for his work as supervisor of the nation-wide cooperative wildlife research program operating in seventeen land-grant colleges.

• **Recent deaths among biologists:**

Asa C. Chandler, Houston, Tex.; internationally known specialist in tropical medicine and parasitology; retired in 1956 as chairman of the department of biology at Rice Institute; author of textbooks. 67; August, 1958.

George H. Collingwood, Washington, D. C.; conservationist and head of the Natural Resources Section, Legislative Reference Service of the Library of Congress; former chief forester of the American Forestry Association; professor of forestry at New York State College of Agriculture, 1916-23. 67; August, 1958.

Louise Dosdall, St. Paul, Minn.; nationally known authority on diseases of ornamental plants; assistant professor of plant pathology at the University of Minnesota. 64; September, 1958.

Gordon F. Ferris, Palo Alto, Calif., professor of biology (entomology) at Stanford University; founder of the journal *Microentomology.* 65; May, 1958.

Lewis Knudson, Ithaca, N. Y.; professor emeritus of plant physiology of New York State College of Agriculture, Cornell University. 74; August, 1958.

Karl S. Lashley, Jacksonville, Fla.; director of the Yerkes Laboratory, a division of Emory University, from 1942 until his retirement in 1955; formerly professor of neuropsychology at Harvard University and professor psychology at the University of Minnesota and the University of Chicago. 68; August, 1958.

Robert F. Poole, Anderson, S. C.; president of Clemson College; former professor of plant pathology at North Carolina State College. 64; June, 1958.

Bell M. Shimada, Guadalajara, Mexico; fisheries biologist and senior scientist with the Inter-American Tropical Tuna Commission, San Diego, Calif.; research associate at the University of California's Scripps Institution of Oceanography. June, 1958.

Harry J. Snook, Stockton, Calif.; biologist and former teacher at Stockton College. 72; August, 1958.

J. Fisher Stanfield, Oxford, Ohio; chairman of the department of botany at Miami University. 57; May, 1958.

Frank T. Woodruff, New Haven, Conn.; retired vice president of Associated Seed Growers, Inc.; specialist in breeding of vegetables. 86; June, 1958.

From the Societies

• Newly elected officers of the **Society of Protozoologists** include: President, Elery R. Becker, Arizona State College, Tempe; Vice-President, Norman D. Levine, University of Illinois, Urbana; Secretary, John O. Corliss, University of Illinois, Urbana; Treasurer, Daniel M. Lilly, St. John's University, Jamaica, N. Y. (retained). Emmanuel Fauré-Fremiet, College de France, Paris, has been elected to Honorary Membership.

The Society is scheduled to hold its next annual meeting with the AIBS in August, 1959, on the campus of Pennsylvania State University, University Park.

• **The Phycological Society of America** elected the following officers for 1959, during the recent AIBS meetings at Indiana University: President, Paul C. Silva, University of Illinois, Urbana; Vice-President, Richard C. Starr, Indiana University, Bloomington; Secretary-Treasurer, William A. Daily, Eli Lilly & Co., Indianapolis.

• During the August AIBS Convention, **the American Society for Horticultural Science** elected the following officers for 1959: President, Freeman S. Howlett, Ohio State University, Wooster; Vice-President, H. A. Rollins, University of Connecticut, Storrs; Secretary-Treasurer, Roy E. Marshall, Michigan State University, East Lansing; Member of the Executive Committee, Walter Reuther, Citrus Experiment Station, Riverside, Calif. Dr. Howlett continues as the Society's representative to the AIBS Governing Board.

The following ASHS awards were presented during the August meetings: Leonard H. Vaughan Award in Floriculture: **J. P. Nitsch,** Cornell University, for Growth Responses of Woody Plants to Photoperiodic Stimuli; Leonard H. Vaughan Award in Vegetable Crops: **Irving L. Eaks** and **Leonard L. Morris,** University of California, Davis, for Deterioration of Cucumbers at Chilling and Non-Chilling Temperatures; Charles G. Woodbury Award in Raw Products Research: **E. L. Proebsting, Jr., G. H. Carter, D. W. Ingalsbe,** and **A. M. Neubert,** Washington State College, Pullman, for Relation between Leaf Nitrogen and Canning Quality of Elberta Peaches; Joseph Harvey Gourley Award: **L. P. Batjer, H. D. Billingsley, M. N. Westwood,** and **B. L. Rogers,** U. S. Department of Agriculture, Wenatchee, Wash., for Predicting Harvest Size of Apples at Different Times during the Growing Season; Alex Laurie Award in Floriculture and Ornamental Horticulture: no award made.

• **The American Society of Human Genetics** recently elected the following officers for 1959: President, Madge T. Macklin, Ohio State University, Columbus; President-elect, C. C. Li, University of Pittsburgh, Pittsburgh, Pa.; Vice-President, F. Clarke Fraser, McGill University, Montreal; Secretary, W. J. Schull, University of Michigan, Ann Arbor; Treasurer, H. W. Kloepfer, Tulane University, New Orleans, La.; Editor, A. G. Steinberg; Directors, James F. Crow, Paul R. David, E. R. Dempster, Gordon Allen, Eldon J. Gardner, and N. E. Morton.

• Newly elected officers for the **Society for Industrial Microbiology** for 1959 are: President, C. L. Porter, Purdue University, Lafayette, Ind.; Vice-President, Leland McClung, Indiana University, Bloomington; Secretary, Brinton M. Miller, Merck, Sharp and Dohme Research Laboratories, Rayway, N. J.; Treasurer, Arthur Kaplan, Headquarters, Quartermaster Research & Development Command, Natick, Mass.; Director 1958-60, E. I.

Dulaney, Merck, Sharp & Dohme Research Laboratories.

• **Harry J. Fuller,** University of Illinois, Editor-in-Chief of the *American Journal of Botany* and Editor of the *Plant Science Bulletin* since its founding, has resigned from these two posts because of ill health. The Editorial Committee of the *American Journal of Botany* has elected **Harold C. Bold,** University of Texas, to succeed Dr. Fuller. **Harriet B. Creighton,** Wellesley College, was chosen to be Editor of the *Plant Science Bulletin* at a recent election of its editorial board. Dr. Bold resigned as Secretary of the Botanical Society, effective September 1, 1958.

• **The Extension Committee of the American Phytopathological Society announces the preparation and sale of seven sets of colored slides** depicting common plant diseases. These high-quality slides, chosen from pathologists from all parts of the U. S., are in 2 x 2 cardboard mounts, numbered and filed in plastic boxes with each set having a syllabus for identification purposes. The slides cost 21 cents each, including postage and insurance. Further information may be obtained by writing to: Photo Science Department, Day Hall, Cornell University, Ithaca, N. Y.

• **The 13th Annual Meeting of the Northeastern Weed Control Conference** will be held January 7, 8 and 9, 1959, at the Hotel New Yorker, New York City. The Conference will be of interest to those concerned with the various phases of weed and brush control; papers on many aspects of this subject will be heard by representatives from research in colleges, industry and government; extension workers; nurserymen; and public health and utility workers. Further information may be obtained by writing E. P.. Marshall, Chairman, Public Relations Committee, Northeastern Weed Control Conference, Union Carbide Research Farm, Clayton, N. C.

• **The Entomological Society of America** will hold its annual meeting, December 1–4 at the Hotel Utah in Salt Lake City. An attendance of 800 is expected and over 300 papers, covering all aspects of entomology, numerous symposia, and outstanding invitational speakers will make up the four-day program. Significantly, entomology will play an important part in research studies of outer space—discussions relating to this new area are expected during the Salt Lake sessions. Robert L. Metcalf, chairman of the Department of Entomology at the University of California Citrus Experiment Station, Riverside, is President of E.S.A. In January 1959 the Entomological Society becomes a full Member Society of A.I.B.S.

• 1958–59 officers of the **American Phytopathological Society** are: President: Glenn S. Pound, University of Wisconsin; President-elect: William C. Snyder, University of California, Berkeley; Vice-President: S. E. A. McCallan, Boyce Thompson Institute; Treasurer: A. W. Dimock, R.R. 2, Ithaca, N. Y.; Secretary: William B. Hewitt, University of California, Davis; Representative to AIBS Governing Board: George L. McNew, Boyce Thompson Institute; Editor-in-Chief: E. E. Wilson, University of California, Davis. The A.P.S. will meet under AIBS auspices at Pennsylvania State University, August 31–September 3, 1958.

Education and Manpower

• **The National Science Foundation has announced the award of grants totaling over $8,600,000 to 32 colleges and universities in support of Academic Year Institutes** designed to help high school science and mathematics teachers improve their subject matter knowledge. The Academic Year Institute Program is being expanded by the Foundation because of its success in the past two years. An estimated 1,500 high school teachers will be enrolled in the Institutes in the 1959-1960 academic year. Each teacher will pursue a program of study in the sciences or mathematics planned especially for him and conducted by leaders noted not only for competence in their field but also for skill in presentation. The grants will provide stipends of $3,000 each to approximately 50 teachers in each Institute. Allowances for dependents and travel will also be provided. *Applications by high school teachers for acceptance in the Institutes should be sent to the directors.* All selections will be made by the host institution, not by the National Science Foundation. The Academic Year Institutes for 1959-1960 follow: *Arizona State College* (A. T. Wager, Department of Physics, Tempe, Ariz.), *Atlanta University* (K. A. Huggins, Department of Chemistry, Atlanta 14, Ga.), *Brown University* (E. R. Smith, Department of Education, 71 Brown Street, Providence 12, R. I.), *University of Colorado* (W. E. Briggs, Department of Mathematics, Hellems Annex 318, Boulder, Colo.), *University of Georgia* (J. J. Westfall, Department of Botany, Athens, Ga.), *Harvard University* (E. C. Kemble, Department of Physics, Lyman Laboratory, Cambridge 38, Mass.), *University of Hawaii* (J. J. Naughton, Department of Chemistry, Honolulu 14, Hawaii), *Iowa State Teachers College* (R. A. Rogers, Department of Science (Physics), Cedar Falls, Iowa), *University of Michigan* (F. D. Miller, Department of Astronomy, 1018 Angell Hall, Ann Arbor, Michigan), *University of New Mexico* (W. Ivins, Department of Secondary Education, College of Education, Albuquerque, N. M.), *University of North Carolina* (E. C. Markham, Department of Chemistry, 210 Venable Hall, Chapel Hill, N. C.), *University of North Dakota* (J. D. Henderson, Department of Physics, Grand Forks, N. D.), *Ohio State University* (J. S. Richardson, Department of Education, 250 Arps Hall, Columbus 10, Ohio), *Oklahoma State University* (J. H. Zant, Department of Mathematics, Stillwater, Okla.), *Oregon State College* (S. E. Williamson, Department of Science Education, Corvallis, Ore.), *Pennsylvania State University* (W. H. Powers, Department of Chemistry, 102 Sparks Building, University Park, Pa.), *State University of South Dakota* (C. M. Vaughn, Department of Zoology, Medicine and Science Building, Vermillion, S. D.), *Syracuse University* (A. T. Collette, Department of Bacteriology and Botany, 400 Lyman Hall, Syracuse 10, N. Y.), *University of Texas* (R. C. Anderson, Department of Chemistry, Austin, Tex.), *Tuskegee Institute* (W. E. Belton, Department of Chemistry, Tuskegee Institute, Ala.), *University of Utah* (T. J. Parmley, Room 215, Physical Science Building, Salt Lake City 12, Utah), *University of Virginia* (J. W. Cole, Jr., Department of Chemistry, Charlottesville, Va.), *Washington University* (E. U. Condon, Physics Department, St. Louis 5, Mo.), *University of Wisconsin* (D. H. Bucklin, Department of Zoology, Madison, Wis.).

• **Hofstra College has announced the formation of a central library of scientific and engineering equipment.** It is to be loaned to neighboring colleges and high schools. The equipment pool, believed to be the first of its kind will make available extensive apparatus that relatively few institutions can afford. The new library was financed by a $25,000 grant from the Esso Education Foundation. Over a three-year period, the Esso Education Foundation expects to disburse $1.5 million in grants to improve scientific and engineering education throughout the United States. In observance of the Standard Oil Company's (New Jersey) 75th anniversary last year, this special fund was awarded to the Foundation.

• **The National Education Association has announced the establishment of a consultant and clearing house service on education of the academically talented.** The new service will be carried on under the administration of the NEA and its appropriate units through a grant from the Carnegie Corporation. The new center will 1) provide consultant service to state and local school systems, to colleges and universities, and local, state and national education associations; 2) keep up-to-date records of experimental and research projects; 3) develop a comprehensive collection of materials on all aspects of the problem; 4) develop plans for needed research; and 5) organize study conferences on specialized topics within the field. The new service is a follow-up of the project carried on during the current year dealing with the identification and education of the academically talented pupil in the secondary school. The director of the new project will be Charles E. Bish,

former principal of McKinley High School, Washington, D. C., who may be reached at Project on the Academically Talented Pupil, National Education Association, 1201 16th St., N. W., Washington 4, D. C. All inquiries about the project should be addressed to Dr. Bish.

• **The AAAS Traveling High School Library Program is being supported for a fourth year by an NSF grant of $500,000.** This year the AAAS and NSF, cooperating with book publishers of the United States, will provide about 1,400 of the nation's senior high schools with 350 circulating libraries, each consisting of 250 carefully selected science books. The Library will go to schools in all 49 states, Canal Zone, Hawaii and Puerto Rico. Fifty books will be sent at a time with exchange approximately every two months, so that each school will have use of a complete set during the year. Evaluation studies made by the AAAS disclose that on the average only 5 percent of books in high school libraries are concerned with science and mathematics. The traveling library program hopes to develop in high school students an interest in reading general books in science and mathematics other than textbooks, stimulate an interest in choosing a career, and offer to science teachers an opportunity to broaden their subject matter knowledge.

In addition to the 350 sets of books that are a part of the regular program, this year an additional seven sets are being lent to the Department of the Army for circulation among the 20 senior high schools that are operated in France, Germany, Italy and Okinawa for the children of U. S. citizens serving overseas. A further four sets will be lent to county library systems for circulation in bookmobiles as an experiment on the appeal of science books to adults and students in rural areas where high schools are too small to participate in the program.

To facilitate use of the books, the AAAS has each year published an annotated catalog of "Books of the Traveling High School Science Library." Demand for this catalog has increased from 300 in 1955 to 22,000 copies in 1957. In 1958 the AAAS hopes to publish "a comprehensive list of science and mathematics books for secondary school and community libraries." To encourage young people to read science and mathematics books and call attention to the many good books in paperbound editions, the AAAS published, as an experiment, in September 1957, a list of these paperbacks entitled "An Inexpensive Science Library," with a first printing of 12,000 copies. The list proved so popular that the first printing was exhausted by December, 1957, and an additional 10,000 were printed. These were all distributed by April, 1958, and a new and enlarged edition has now been prepared.

• **The Atomic Energy High School Demonstration Program "This Atomic World" is currently "on the road" in seven panel trucks.** This year's schedule will bring the program to 1,069 schools in 15 states before the end of the school year.

• **The Office of Education has announced that it is prepared to consider applications for Federal funds to support research projects in educational television, radio, motion pictures and related communications media.** The National Defense Education Act authorized $3 million for the year and $5 million for each of the succeeding three years to support research in these areas. Inquiries concerning the new research program should be directed to the Director, Communications Media Research Program, Office of Education, Department of Health, Education, and Welfare, Washington 25, D. C.

• **The National Science Foundation has announced that it will expand its program of Traveling Science Demonstrations,** previously administered solely by the Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tenn., to include a few regional centers throughout the country. Proposals are invited from educational institutions and non-profit organizations concerned with scientific education. Appropriate individuals will be selected by the regional centers to receive three summer months of intensive training designed to prepare teachers to give lecture-demonstrations in physics, chemistry, biology or mathematics in a number of high schools during the 1959-1960 school year. Each traveling lecturer will spend three to five days at approximately 30 to 40 representative secondary schools throughout the geographical area served by the regional center. The traveling teachers will give demonstrations to students, assist local science teachers, encourage students' interest in science, and meet with other groups as required during a one-week stay at each school. Organizations and educational institutions desiring to submit proposals may wish to collaborate in the use of their facilities in order to serve their areas more effectively. Use of community resources, such as museums, where this is appropriate for training purposes, is encouraged.

Suggestions for preparing proposals and necessary details of this program may be obtained from the Special Projects in Science Education Section, Scientific Personnel and Education Division, National Science Foundation, Washington 25, D. C. Proposals for programs beginning in the summer of 1959 should be received by the Foundation not later than December 15, 1958.

• **The Scientific Apparatus Makers Association recently announced the availability of "A Guide for Evaluating Your Science Facilities."** This publication was prepared by the Scientific Apparatus Makers Association's Laboratory Equipment Section in cooperation with the School Facilities Council. It was written as a public information service for school administrators, school board members, architects and other persons interested in providing adequate educational facilities. Request for copies should be addressed to: Science Guide, Scientific Apparatus Makers Association, 20 North Wacker Drive, Chicago 6, Ill.

• **In step with current plans for strengthening the training of scientists in the United States, the Audio-Visual Center, Indiana University, has released three new science films in biology.** Stressing the significant roles played by microorganisms in the biological world, the films show how man studies, uses and controls bacteria. "Bacteria: Laboratory Study" shows characteristics of microorganisms and proper methods for studying them. "Microorganisms: Beneficial Activities" points out many common uses of bacteria in everyday life and indicates that most microorganisms are beneficial to man. "Microorganisms: Harmful Activities" explains how microorganisms cause diseases and how they can be controlled. Agencies interested in considering any of the films in this series may obtain preview prints from the Audio-Visual Center, Indiana University, Bloomington, Ind., at no cost other than return postage. Prints of these films can be purchased from the Audio-Visual Center and from the Educational Film Library Association, 250 West 57th St., New York 19, N. Y. Costs are: 15 minutes, sound, color, $150; black and white, $75. These films, like all other Indiana University productions, are available on an annual rental plan which leads to ownership. Inquiries about details of this plan may be obtained by writing to the Audio-Visual Center, Indiana University, Bloomington, Ind.

• **The Society of American Foresters has announced a nationwide study of education in forestry and related fields of natural resources management.** The project has been made possible by a grant from the Old Dominion Foundation, Inc. of New York City. The appraisal is being undertaken at the request of representatives of 25 colleges and universities because of the nation's economic and social dependence on forest and related renewable natural resources and on their products and services. The study, expected to continue over a period of two years, is being directed by Harold G. Wilm, Associate Dean, College of Forestry, State University of New York, Syracuse, N. Y.

• **The National Science Foundation has invited universities, colleges and other non-profit institutions with appropriate research facilities to submit proposals for support of Research Participation Programs for Teacher Training.** It is planned to support a limited number of experimental programs which will provide research experience during the summer months for teachers

of science and mathematics in high schools and small colleges, under the tutelage of experienced scientific investigators. The fundamental purpose of these programs is to encourage the development of opportunities for the further training of teachers so that their teaching will become more meaningful and stimulating.

Science teachers with adequate scientific background can become better acquainted through these research participation programs with the nature and methods of research. Actual laboratory experience will form the basis of these programs, and may be augmented by appropriate seminars or courses on scientific subjects and research techniques, with the objective of improvement of science teaching.

Support will be provided by the Foundation for stipends and travel for approximately 700 teachers and for expendable supplies, secretarial and administrative expenses, and other institutional costs directly attributable to the teacher training aspects of the programs. Suggestions for preparation of proposals may be obtained from the Special Projects in Science Education Section, Scientific Personnel and Education Division, National Science Foundation, Washington 25, D. C. Proposals for programs beginning in the summer of 1959 should be comprehensive for all participating departments within an institutional unit, and should be received by the Foundation not later than *December 1, 1958.*

• **The National Science Foundation announced that it will accept proposals from universities and colleges interested in sponsoring In-Service Institutes for Secondary School Teachers of Science and Mathematics to be held during the academic year 1959-60.** The Foundation plans to support about 200 such Institutes, designed primarily to assist colleges and universities in their efforts to encourage teachers in local and outlying school districts to take advantage of scientific training facilities not otherwise readily accessible to them. Directions for preparing proposals may be obtained from the Institutes Section, National Science Foundation, Washington 25, D. C. Deadline for submission of completed proposals to the Foundation is *December 15, 1958.* Awards will be announced on or about March 1, 1959.

In-Service Institutes will offer work in the subject matter of science and mathematics especially designed for teachers. Institute meetings will be held outside regularly scheduled school hours—e.g., evenings, Saturdays, or late afternoons—so that teachers may attend while still teaching full time in their schools. A typical Institute might meet once a week for two hours for the full academic year of about 30 weeks. Half of these meetings might, for example, be devoted to laboratory work.

It is possible for a particular institution to offer courses in more than one subject matter area in these in-service programs. Courses could be offered simultaneously, though not necessarily on the same evening, in mathematics, physics, chemistry, biology, etc., for instance. Any given participant should probably be limited to attending no more than two of these if he is to find time to do a good job on each. The In-Service Institute program contemplates that each group will be kept to less than thirty members so that discussion may be full and free.

Foundation support to In-Service Institutes will cover all tuition and fees, plus any other direct costs to the college or university directly attributable to the program. Though the Foundation does not provide stipend support for participants in the in-service program, the NSF grants provide funds to underwrite travel expenses in connection with attendance at the Institutes.

• **The following notice** was recently received in the AIBS office: "Many of those attending college in Idaho for the past three years as teachers, and especially those who have taken the course offered in conservation, now having had a chance to go out into the schools and put their outlines into the intended use, usually wish to check up on the recent materials within their level of teaching to realize how they might improve upon them or work with others to revise them. A realization of what other states are doing should present some worthwhile facts to work on. Any materials you may have for us will be greatly appreciated, and made good use of in the next few weeks. Thank you. George B. Frazier, 203 Venice Avenue, Nampa, Idaho."

• **The 38th Annual Report (1957) of the Institute of International Education was issued recently.** The Report stated that during 1957, 43,391 citizens of other nations studied in American colleges and universities. This is the greatest number in history. In 1957, IIE played a role in a unique international education movement—that of placing 734 of the 1,288 displaced Hungarian students. In 1957 too, the Institute was able to participate in the reopening of exchanges with Poland. Educators in general will find the report of considerable interest. Copies may be obtained from Institute of International Education, 1530 P Street, N.W., Washington 5, D. C.

• **The National Science Foundation announced plans** to make a limited number of grants to colleges, universities, and non-profit research institutions **to provide, on an experimental basis, opportunities for properly qualified undergraduates majoring in the physical, biological, mathematical, and engineering sciences to participate in research projects** currently being conducted by experienced scientific investigators. This experimental program may operate either during the academic year or during the summer; summer programs in particular may extend the benefits to students from other colleges.

Approximately 1000 undergraduates at some 100 institutions throughout the country are expected to participate in these laboratory and field programs which will afford an opportunity to become acquainted with the nature and methods of research in progressively more independent roles.

The Foundation will provide support for undergraduates, in accordance with prevailing campus practices, for a maximum of 400 hours per student. Expendable supplies and secretarial and administrative expenses directly attributable to this student training will also receive support.

Directions for preparing proposals may be obtained from the Special Projects in Science Education Section, Scientific Personnel and Education Division, National Science Foundation, Washington 25, D. C. Proposals for programs beginning in the summer or fall of 1959 should be comprehensive for all participating departments within an institutional unit, and should be received by the Foundation not later than December 15, 1958.

• **The Federation of American Societies for Experimental Biology has just completed a study of the Scientific Register covering experimental biologists.** The analysis was limited to those holding doctoral degrees. Of the 9,237 respondents to the Federation's questionnaire, 58 percent held Ph.D. degrees, 33 percent M.D. degrees, and 9 percent had at least two doctoral degrees. Less than 0.3 percent were women. 55 percent of the experimental biologists were employed in universities, 10 percent in industry. 52 percent considered research their major function, 23 percent teaching. Median salary for the entire group was $8,405, but it rose steadily with experience ($11,774 for the thousand men with 28 years or more of professional work behind them). As in other fields of science, universities paid the lowest salaries, industry the highest. Specialties covered included physiology, biochemistry, pharmacology, pathology, nutrition and microbiology.

Had biologists with Masters and Bachelors degrees been included, the ratio of those in industry would be considerably higher, for the Scientific Manpower's Industrial Survey has shown that six Bachelors and Masters are hired to one Ph.D. or M.D. by chemical and food concerns.

• **The Woodrow Wilson Fellowship Foundation has launched a $25,000,000 Five-Year Program under a Ford Foundation grant for graduate training of prospective college teachers.** Designed to meet the critical need for college teachers in the natural and social sciences and the humanities, the program is designed to fit both men and women to teach in fields ranging from the classics to nuclear physics and from languages to higher mathematics. Colleges in the U. S.

and Canada are accepting nominations for these fellowships for the academic year 1959-1960. The nomination of a student by a faculty member of his college is the first step. Regional committees of educators analyze all nominations, personally interview applicants and make the final recommendations for the 1,000 fellowships to be awarded. Each fellowship pays the full cost of tuition and fees for the first year of graduate study and provides a living allowance of $1,500 for single students with an additional allowance for dependents. Further information or copies of a memorandum on the fellowships may be obtained from: National Director, Woodrow Wilson National Fellowship Foundation, Box 642, Princeton, N. J.

• **The Biology classes at Natick High School** have begun to make use of some of the natural environment the school is fortunate in having nearby.

The campus type school is situated on the shores of a large pond and is surrounded on two sides by a naturally wooded area. Therefore, to make use of this area and to help the students better understand the interesting things found in the out-of-doors we have begun the following projects.

First on the list is the development of a nature trail in the wooded area behind the school. This trail, when completed, will be about one-half mile in length. The students had to terrace the slope to the pond. This consisted of leveling off a path one and one-half yards wide. They also had to clean out the shrub growth along the trail.

The tree department of Natick has cooperated with us by pruning the tall trees and also in the removal of stumps and dead trees. All trees and shrubs along the trail will be classified. This will be done by tagging all plants with wooden markers to include their identification and other pertinent data (such as genus, species). Many of our local florists have donated perennial type plants which are to be planted along the path for study.

Bird houses and feeders, made by the students, may be found on either side of the trail. Many of these houses are already inhabited by several different species of birds. This makes for an ideal situation in bird study.

Along the trail will be set up several stations. Each station will be marked with a numbered wooden stake. At each of these locations there will be something of interest to be studied in the field of science. A pamphlet, written by the students, will include all pertinent information pertaining to each station.

On the west side of the science building we have developed a plant propagation area. This plot of land is utilized in the development of different species of plants and trees. From this area the plants may be transplanted along the nature trail wherever they are needed. In this propagation area we teach the subjects of grafting, pollination and prevention by soil erosion.

In some places the nature trail comes very close to the pond's edge. We plan, with help offered to us by the department of conservation, to set off a portion of the pond as a breeding area for fish. In this area we will also construct a hatchery, with tanks for hatching and grading the growth of the fish.

Another project which is still in the distant future will be to have the students build a glass bottom boat for the study of underwater life in the pond.

We are fortunate in having a well-defined valley to the west of our school which we hope to develop into an amphitheater in the near future. This will be complete with lectern and wooden benches for out-of-door study.

With the cooperation of Mr. Charles Marso and Miss Mary Leavitt, the other two biology teachers in our department, we have divided these projects into several sections. Each biology class will be responsible in completing one section each year until the entire plan is completed. *Tassos P. Filledes, Natick High School, Natick, Mass.*

• **Brown University (Providence, R. I.) has initiated a new interdepartmental program in human biology.** The new program is jointly sponsored by the Departments of Biology, Psychology and Sociology. The courses will emphasize three areas: 1) The evolution of man, his historical development and an analysis of the causal factors operating on him. 2) The study of environmental influences now acting upon man. 3) The development of mathematical and statistical perception in order to understand the modern theoretical models which apply to evolutionary problems and environmental relationships. Required courses are: 1) Biology: Human Heredity or Genetics, Senior Seminar in Human Biology, two of the following—Comparative Anatomy, Embryology, Introductory Physiology or Bacteriology. 2) Psychology: Statistical Methods in Psychology, one of the following—Psychological Testing, Normal and Abnormal Personality or Social Psychology. 3) Sociology: Human Origins, two of the following—Cultural Anthropology, The Community, Population and Migration, or Races and Minority Groups. 4) Mathematics: Analytic Geometry and Calculus. Recommended electives are Mathematical Statistics, Experimental Psychology, Behavior Processes, Experimental Psychology, Receptive Processes, and various courses in physics, geology and chemistry. To guide the students concentrating in the Human Biology program, various orientation seminars are planned. Further information about this interdepartmental program may be obtained from Jack B. Bresler, Department of Biology, Brown University.

• **"Career Opportunities in Biology"** written by Russell Stevens and published in first printing by Row Peterson of Chicago has now been reprinted by the Publications Office of the National Academy of Sciences-National Research Council, 2101 Constitution Ave., Washington, D. C., and is available for $1.00 per copy.

Letters to the Editor

The January (1958) issue of the *AIBS Bulletin* carried an excellent editorial by our Executive Director, Dr. Hiden T. Cox, commenting on the low prestige accorded biologists and exemplified in particular by the then recent financial discrimination on the part of the Federal Government.

I have since had correspondence with Dr. Cox in which I have suggested that we in science, and the learned professions generally, invite such an attitude. This *Bulletin* affords an excellent example. On the masthead Dr. Cox is listed as "Hiden T. Cox, Executive Director." To state his academic qualifications or degrees would be considered brash in the extreme, despite the fact that as far as the general public knows he, and the rest of us, may have failed kindergarten. Each and every one of us goes through the farce of searching through *American Men of Science*, university catalogues, etc. to see whether we should answer John Doe's letter as "Dr. J. Doe" or "Mr. J. Doe."

This is in sharp contrast to the precedent firmly established by the medical profession. The B.A. and Ph.D. are considerably older degrees than the M.D. or D.D.S., yet members of the general public (and members of our own Institute also I am afraid) are quite aware that "doctor" was a title of honor for learned men when the "chirurgeon" was synonymous with the barber. I suggest that much of the M.D.'s enormous prestige (and very considerable financial recognition) is attributable to the universal use of the prefix "Dr." or the suffix "M.D." on *all* professional (and even social) occasions.

Therefore, I suggest that the executives of the various member societies within the A.I.B.S. poll their members as to the desirability of adopting a group policy of advising the use of members' highest academic degrees (M.A., Ph.D., D.Sc., etc.) wherever the medical profession uses M.D., D.D.S. or the prefix Dr.

Interest in some such measure is not limited to A.I.B.S. members. The American Association of University Professors is another group that is intimately concerned and who must have considerable representation in the A.I.B.S. For years various aspects of this problem have been debated in the correspondence columns of *Chemical and Engineering News*. In particular I might draw attention to the very lucid letters from Peter D. Moskovits in that journal (p. 15, Feb. 3, and p. 12, March 10, 1958). The recent (September 29, 1958,

pp. 80-81) issue of *C. & E. News* reports that the Policy Committee of the American Chemical Society has recommended the use of academic titles with authors' names when signed material is used in A.C.S. publications. Perhaps A.I.B.S. should seek a common policy with A.C.S.?

The post-Sputnik era has drawn attention to the fact that learning and academic qualifications generally are in strangely low repute in the United States (and in Canada also) as compared with the rest of the world. The present deplorable tendency to make comparisons only with the Russian system draws attention away from the fact that even more valid comparisons can be drawn with a wide range of countries whose political systems are less at variance with our own. This is particularly true in the matter of the deliberate nonprotective coloration adopted by our learned professions generally.

I suggest that A.I.B.S. members to whom my views seem extreme pick up a copy each of *Science* and of *Nature*. As a general rule *Nature* acknowledges doctorates and professorships. *Science* goes so far in the other direction as to ignore such practice with distinguished European authors such as Professor O. Warburg to whom such practice must seem strange at least. (Here let me note that the *Bulletin* extends to such authors the courtesies to which they are used, e.g. Dr. Anton F. Bruun in the January issue.) No one could accuse *Nature* of a lack of dignity.

The use of professional qualifications is admittedly a very minor point in the status of research workers and teachers generally, and Dr. Cox tells me he is "less enthusiastic . . . about changing the habits of American scientists". But how can we expect recognition if we are too timid to hold up our own heads?

One purpose of this rather lengthy communication is to help re-establish a Letters to the Editor column as a much needed forum in which professional biologists (a strangely inarticulate group) can discuss such problems as those raised by Dr. Cox in his editorial. Whether the seed sown here falls on barren ground or not will depend on readers whose replies, no matter how acrimonious, are invited.

Time magazine recently commented sardonically on the fact that a scientific writer on this same theme was too inhibited to practice what he preached. Even A.C.S. correspondents such as the above noted Mr.(?) Dr.(?) Moskovits have not ventured to break the ice by actually using their academic degree as a part of their signature. Someone has to be bold enough to try to make a start, so as a matter of principle, I will sign myself,

W. Grierson, Ph.D.,
University of Florida
Agricultural Experiment Station,
Lake Alfred

August 1, 1958

In hope that a few slices may be more appetizing than none of the loaf, I accept your suggestion to write a letter in place of my rejected article, "A Tirade on the Teaching of Biology in the Twentieth Century". My good friend Fred Norris advises that anyone who labels writing "A Tirade" will be in turn labeled a radical and ignored. So, I might call my letter, "A Modest Proposal—for the Modernization of Biology Courses". (Everyone favors modesty and most are for modernization.)

I submit that there are some new and significant ideas which have come to be in this century, and biology might be seen as a real science of life, not a parlor game, if they were used as core material for our courses instead of the late 19th century structure now popular. These six hot ideas (or principles, or concepts, or theories, or approaches) deserve a better place than the one now being allotted them—if any.

Relativity. Relativity is not Dr. Einstein's (or even physics') abstruse apple. The challenge to absolute standards is a general one that greatly disturbs many people. Men may come to fight over it, but for the present it might be safe to point out that we understand phenomena in comparison with other phenomena, and that such comparison calls for creative imagination.

Change. The ideas of relativity and change are connected, and the realization that change is apparently continual, unending, and inevitable is also a devastating one. It calls for reorientation of the public view which expects "final" solutions to problems—be they in the millenium, heaven, Salk vaccine, or DDT. If change is properly appreciated life (and biology) emerges with a new dynamic model. Only a beginning has been made to extend man's perspective backward and forward in time; at least "development" and "consequence" are more important words than they once were.

Emergent evolution. Biologists, who had most of the evidence before them, must credit a philosopher, Charles Peirce, with this concept. I think that Jan Christian Smuts' "holism" must be placed with it, as well as the "organismic" approaches of some others. Essentially, they state that an organization becomes more than the collection of individual components. New properties, and the possibility of contriving laws for these properties arise. With such a working idea, "social" biology needs no further apologies, and investigation of human and other social units is as legitimate as studies of lower orders of organization.

Ecology. Although the recognition of ecology as a major approach to life occurred about the same time that "holism" was offered, its fate has been better. Ecology has managed to become respectable and fruitful, and its subject matter has broadened so that we no longer know its limits. The environment of a gene and population control of Ireland are now both within it. How much ecology is there in most biology courses? Is there any mention of human ecology—the effect of this school or that church?

Information Theory. The idea of expressing relationships in terms of flow and storage of organized energy has provided a universal language for ecology. The recent excited talk of automation as a cure for man's ills (industrial at least) is lacking in appreciation of the tremendous implications of feedback and self-correction in biology. On the social level, there is the possibility of gaining a vastly increased appreciation of why we act as we do and thus gaining a new degree of independence of the influences imposed upon us.

Experimental genetics. This designation is not satisfactory, but I lack a better. The central idea is that we can produce hereditary change systematically, and it is no older than Muller's work. Muller, in effect, shifted to an active approach. Now that millions of *Drosophila* have laid down their chromosomes for progress, and we have reached nucleic acids and Watson-Crick models, the possibilities for life are far more awesome than artificial satellites and moon rockets. There is some evidence that experimental genetics has deeply disturbed timid souls.

I have tried these ideas on a (bright, to be sure) high school group. The students handled them without difficulty, and kindly pointed out to me that they constitute rank heresy (against 19th century biology?). The students also found them vital, so I shall wait patiently for the next century when they might be taught with proper emphasis.

Herman S. Forest,
1833 White Ave., S.W., Knoxville, Tenn.

A.I.B.S. Reports

• **Future sites for annual AIBS-sponsored meetings** for biological societies are: 1959, Pennsylvania State University, University Park, August 30-September 3; 1960, Oklahoma State University, Stillwater, August 28-September 1; 1961, undecided; 1962, undecided; 1963, University of Massachusetts, Amherst.

• **The AIBS Advisory Committee on Hydrobiology** to the Office of Naval Research held a classified meeting June 26-27, 1958, in Washington, D. C.

• **The AIBS Advisory Committee on Biology** to the Office of Naval Research met August 24, 1958 at Indiana University, Bloomington. The panel reviewed 21 proposals for their scientific merit.

• **The AIBS Education and Training Advisory Committee** to the Atomic Energy Commission met in Washington, D. C., September 22-23, 1958. The Committee reviewed and evaluated 36 equipment proposals.

• **An ad hoc AIBS Conference on the Chemistry of Organo-boron Compounds,** sponsored by the Atomic Energy

Commission, was held September 25, 1958 at the Sheraton-Blackstone Hotel, Chicago, Ill.

• **An AIBS-National Institutes of Health-Atomic Energy Commission Conference on the Similarities and Differences between Physiologic Aging and Radiologic Life Shortening** held a meeting of its Panel Chairmen October 3-4, 1958 at the University of Colorado, Boulder.

• **The AIBS Advisory Committee on Microbiology** to the Office of Naval Research did a mail evaluation of 13 proposals during October, 1958.

• **The AIBS Advisory Committee on Physiology** to the Office of Naval Research also did a mail evaluation of 5 proposals during October 1958.

• **The newly established AIBS Advisory Committee on Cancer** to the Atomic Energy Commission held a two day meeting, October 9-10, 1958, at the Washingtonian Motel, Germantown, Md. Jacob Furth, Children's Cancer Research Foundation, Boston, is chairman of the Committee. Members are: Louis K. Alpert, Howard B. Latourette, Charles Heidelberger, and E. R. Woodward.

• **A meeting of the U. S. participants in the 1957 Moscow Origin of Life Symposium** was held under AIBS auspices October 17-18 at the Claremont Hotel, Berkeley, Calif. Barry Commoner, Washington University, served as chairman.

• The AIBS, working through a selection committee appointed by appropriate societies, with funds from the National Science Foundation, awarded **20 travel grants to the 9th International Zoological Congress,** held in London, England in July 1958.

• Through a grant from the National Science Foundation and with funds raised by the Society of American Bacteriologists, **32 biologists were awarded travel grants to the 7th International Microbiological Congress,** held in Stockholm, Sweden, August 1958. The AIBS arranged for the appointment of a selection committee and administered the fund.

• **Wallace O. Fenn,** President of AIBS, recently delivered the dedication address, "Perspectives in Biology" for the new Biology Building at Bryn Mawr College.

• **AIBS Placement Service.** At the recent Bloomington meeting the AIBS Placement Service registered 140 candidates during the convention period, with approximately 65% scheduled for interviews. Over 65 employers were in attendance to interview prospective employees. Prior to the convention and during the four days of sessions over 100 positions (teaching and research) were registered.

As a further service in commemoration of the 50th Anniversary of the American Phytopathological Society, a representative from this Society was present each day in the Placement Service office. He devoted his time to discussing the possibilities of employment in the field of phytopathology and to vacancies with which he was familiar. The AIBS would like to express appreciation for the fine contribution that he made to the success of the Placement Service activities.

The Placement Service Directories are published in January and June of each year. Based upon past experience, the Service recommends that all June graduates in biology (1959), who may be seeking placement, register for the January issue of the Directory. Deadline for registration is *December 22, 1958.* Application forms may be obtained from the AIBS Placement Service, 2000 P St., N.W., Washington 6, D. C. Employers interested in obtaining this list of registrants may do so for $1.00.

• With funds from a National Institutes of Health grant, the AIBS administered the award **of 27 travel grants to a Symposium on Biochemistry of Morphogenesis,** held in connection with the 4th International Congress of Biochemistry, in Vienna, Austria, September 1958. Ten of the grants were for U. S. scientists and 17 for European biochemists.

• **AIBS will assist the Atomic Energy Commission in arranging speakers for the MEND program.** MEND (Medical Education for National Defense) is a joint Federal agencies-medical school program designed to better acquaint the medical student with the principles of military and disaster medicine. Participating colleges of medicine are provided with a modest stipend, mainly for the purpose of faculty travel to MEND-sponsored educational programs, and are given access to medical training resources of the sponsoring agencies — Department of Defense, Public Health Service, and Office of Civil Defense Mobilization — including special courses, visual aids, and publications.

There are presently 55 medical schools affiliated with MEND. Expansion is at the rate of ten schools per year, with applications for affiliation far exceeding the number of schools which may be included, so that a waiting list has been maintained. It is anticipated that MEND will continue to expand until all medical schools desiring affiliation will be afforded that opportunity. Since its initiation in 1952 as an experimental program in education, MEND has been given the official approval of many Federal and non-governmental medical organizations.

The Atomic Energy Commission, Division of Biology and Medicine, plans to assist in the MEND Program. Particularly they are interested in making certain that the general field of radiation biology is covered in this program. To accomplish this, they have contracted with AIBS to furnish speakers to each medical school requesting a lecturer. Each school is entitled to visits from two speakers during the academic year. Many subjects of vital interest to national defense will be offered each medical school. Subjects, among others, will include the following: radiation injury, the effect of radiation on living tissue from the molecular level to whole body exposure, "fall out", decontamination, treatment of radiation injury, thermal burns, blast injury, mass casualties in relation to radiation injury, and reports on the exposure of the Rongelap natives and other reports of radiation accidents.

All arrangements for this Program will be made through the AIBS using a pattern which has already proven to be successful in the AIBS Visiting Lecturers Program where scientists are being furnished to small liberal arts colleges to give stimulus to science programs.

• **The 9th Annual Meeting of Biological Societies,** under the auspices of the AIBS, met from August 24-28 at Indiana University, Bloomington. Twenty-five biological societies presented programs which included approximately 1500 papers. With 3898 biologists registered (4,681 in attendance) this 9th Annual Meeting was by far the largest in AIBS history. E. C. Stakman, University of Minnesota, presented at the Monday evening General Meeting, the keynote address (see this issue) of the American Phytopathological Society's Golden Anniversary Program. This program was highlighted by topical symposia, by a special 26 booth exhibit in the AIBS Exhibit Hall and by an Anniversary Banquet attended by well over 900 persons which honored the charter members and past officers of the Society.

• **The 1st International Symposium on Submarine and Space Medicine** was held September 8-12, 1958, at the U. S. Naval Submarine Base, New London, Conn. Funds were provided by the Advanced Research Projects Agency and the Symposium was administered by AIBS, with the assistance of the U.S.N. Medical Research Laboratory. Over 200 scientists were in attendance and for the first time specialists in the two areas of research were provided an opportunity to discuss joint problems and plan future investigations. It is hoped that the proceedings of the Symposium will be published in the near future.

COVER PHOTOS

The *Bulletin* staff is interested in obtaining good photographs of unusual biological material that might be suitable for use on the cover. All such photos should be submitted as glossy prints, of reasonable size, with fine detail. An accompanying note about the subject is requested. The shape of the available cover space should be taken into consideration. Photos used will receive acknowledgments on the masthead page.

Biology Library

One copy of each publication submitted for listing should be sent to the Editor, AIBS Bulletin, American Institute of Biological Sciences, 2000 P Street, N.W., Washington 6, D.C. Only books published within a year of receipt will be reviewed. Books marked with an ★ are those published by Bulletin advertisers.

ANIMAL SCIENCES

The Physiology of Fishes, Vol. I, Metabolism. Edited by MARGARET E. BROWN. 447 pgs., illus. Academic Press, New York. (1957)

At irregular intervals, branches of the tree of science spurt in their growth. Often these spurts are due to great discoveries, but sometimes they result from the convenience offered by the appearance of a masterful and/or critical synthesis of existing information. Herpetology received a great stimulus in 1931 with the publication of G. K. Noble's "The Biology of the Amphibia". Ichthyology, its cold-blooded sister science, has been without a comparable impetus since David Starr Jordan's "Guide to the Study of Fishes" in 1905 and W. Wunder's "Physiologie der Süsswasserfische Mitteleuropas" in 1936. Publication of the work of Miss Brown, and those who finally became associated with her, has changed this.

It would be falsely courageous, if not boastful, for any reviewer to attempt critical appraisal of the nearly one thousand pages of text in these two volumes. Each chapter has been written by a person very competent (and willing) to treat his subject—often a chapter author is the authority (in the English-speaking world) in the fish-physiological field on which he reports. Among others, this can be said for Hoar (endocrines), Brown (experimental growth), Harvey (luminous organs), Hasler (olfactory and gustatory senses), Doudoroff (water quality requirements), and Gordon (physiological genetics). As a result, the topics included are given a super-encyclopedic treatment, with rewarding care being taken to suggest promising avenues of future investigation as judged from existing theory and fact. The result is a solid cornerstone for progress, not merely a headline hunting hybrid such as "The Ways of Fishes" (Schultz and Stern, D. Van Nostrand Co., 1948).

Not unexpectedly in such a multiple-authored work, the treatment is irregular in intensity and approach from chapter to chapter. Inevitably, within a subject, the personal specialized research interest of the author stands out, and the straining of machinery is audible (striving for balance in composition). Too, there are fewer than desirable cross-references among the contributions—a situation easily corrected in future editions when all authors, not only the hard-working editor, can see the whole. Because of this modest cross-integration, even specialists are best served by reading generously beyond their particular interests. In the same vein, some contributors seem to have used references that others might profitably have used also.

Treatment accorded other organ systems (more or less a chapter on each) was not given to the skeletal and muscular ones. Related to the foregoing, locomotion too is not included.

The infusion of German, French, Japanese, and Russian references into the articles is heartening, even though the use of non-English literature is not as extensive as possible truly to label the work a world compendium. Aquatic biologists and behavoral scientists look forward to continuity, through revision of this outstanding work. *Karl F. Lagler, University of Michigan*

The Physiology of Fishes, Vol. II, Behavior. Edited by MARGARET E. BROWN. 526 pgs., illus. Academic Press Inc., New York. (1957) $14.00

Volume II of *The Physiology of Fishes*, subtitled *Behavior*, is the companion volume to volume I, subtitled *Metabolism* (1957). Together they provide a rich compilation of our knowledge concerning the physiology of fishes, in the very broad sense of the word. The scope of this volume is extensive and detailed, and will be of great value to those in the field, as well as to those in related fields.

Chapter I, which covers the first fifth of the book, deals with the Nervous System, by E. G. Healey. The second chapter is devoted to the sense organs and includes The Eye, J. R. Brett; The Acoustico-Lateralis System, O. Lowenstein; Olfactory and Gustatory Senses, Arthur D. Hasler. The third chapter entitled Behavior includes: Conditioned Responses, H. O. Bull; The Ethological Analysis of Fish Behavior, G. P. Baerends; Reproductive and Parental Behavior, L. R. Aronson. The next seven chapters dwell on the subjects of: The Swimbladder, F. R. Harden Jones; Electric Organs, R. D. Keynes; The Luminous Organs of Fishes, E. Newton Harvey; The Pigments of Fishes, D. L. Fox; Color Changes, J. M. Odiorne; Water Quality Requirements of Fishes and Effects of Toxic Substances, Peter Doudoroff; Physiological Genetics of Fishes, Myron Gordon.

Each chapter is written clearly and some with more authority than others. Here, for the first time, there has been gathered together the many and varied aspects of the physiology and the behavior of fishes. It is a source-book that has long been needed, and should serve as a standard reference, in addition to offering suggestions for further research. *Ross M. Horrall, University of Wisconsin*

General Zoology. MARY J. GUTHRIE and JOHN M. ANDERSON. 708 pgs., illus. John Wiley and Sons, Inc., New York. (1957) $7.50

This is an authoritative, easy to read, excellently illustrated textbook. Descended from the successful four editions of Curtis and Guthrie's standard work on General Zoology, it covers recent progress in zoological concepts and retains the flexible organization and logical emphasis which characterized its predecessor editions. It is a new book, indeed, not a revised edition.

Among the many special features in this textbook, the following will be very helpful to teachers and students: (1) The interesting figures, word-diagrams, and illustrations which save many words of explanation. (2) The discussion of cellular metabolism accompanied by a useful and attractive flow chart. (3) Consistent reiteration of the basic concepts of cellular metabolism in the chapters on the Phyla. (4) Full citations to original articles in accessible journals. (5) Rewarding treatment of new ideas, for example, the presentation of ideas regarding the role of glutathione in the feeding reaction of hydras. (6) A thoughtfully prepared glossary. (7) A good quality of paper and restfully legible type. The authors have achieved their aim to present a book which can be read with enjoyment and usefulness. *Harold E. Finley, Howard University*

★Genetic Resistance to Disease in Domestic Animals. FREDERICK BRUCE HUTT. 198 pgs. Comstock Publishing Associates, Cornell University Press, Ithaca, New York. (1958)

With the zeal of a missionary and the concern of a geneticist, the author makes a plea for wider use of genetical knowledge and methods for the development of animals resistant to disease. He recognizes that under some circumstances it is wise and necessary to control the environment of domestic animals rather than to breed for disease resistance. Nevertheless, control of pathogens by slaughtering all animals of a herd exposed to an organism or by the injudicious use of vaccines ignores the potential value of genetic resistance to disease and deflates that most sensitive appendage of man, his pocketbook.

Research data to prove that genes are responsible for animal resistance to disease are scanty. The author marshals the available evidence that animals differ genetically in resistance. He does this by discussing anomalies, or diseases, which are lethal and which occur only in animals that are homozygous for a gene. Aberrant metabolism is known in many organisms, including man and domestic animals, and these defects are cited as genetically determined diseases. A genetic basis for resistance to disease and for ability to tolerate severe environmental conditions is more difficult to establish. But the author gives many examples of laboratory and small animals, large domestic animals, and poultry that by action of nature or man have been made resistant to disease or able to cope with undesirable environmental agents.

Nature may select for disease resistance. A good example of this is shown by oysters

around Prince Edward Island. A disease almost wiped out the native oyster, and introduced oysters survived no better. Within a few years, though, the native restocked itself with descendants of animals that had been able to resist the pathogen. Some rabbits in Australia survived an introduced disease that at first destroyed a high proportion of the mammals. The remaining rabbits have descendants that are coping with the disease, possibly because of a genetic resistance.

Breeds of animals differ in their ability to resist environmental conditions. Zebu cattle stand heat better than do European types. The Zebu also are more resistant to tick-borne disease, due apparently to the thickness of their skin and the smoothness of the coat of hair. White Leghorns are able to resist heat more easily than are other breeds of poultry. Leghorns also have a thermoregulatory mechanism that makes them resistant to some disease causing organisms which are more harmful to other breeds. Honey bee colonies have by selection been made resistant to foulbrood. In one resistant strain, at least, the bees use the man-method of eradicating the pathogen. They clean out the infected cells before the colony is destroyed.

The animal breeders and veterinarians who prefer to control disease only by eradicating the pathogen or by using vaccines are taken to task. The method does not preserve the resistant as against the susceptible animals. It is little better than the costly practice followed in England of slaughtering flocks of poultry in an unsuccessful attempt to control Newcastle disease. A preferable procedure is suggested, that a program of eradication and breeding for resistance be combined. If the health of man is involved, as with tuberculosis in cattle, eradication may be the method of choice. Often, though, breeding experiments can and should be used in order to develop resistant strains which can be distributed to animal breeders. Expense and time will be too much for many of the breeders. The author suggests that governmental agencies may have to take the lead. *Clarence P. Oliver, The University of Texas*

***General Zoology.** TRACEY I. STORER and ROBERT L. USINGER. 644 pgs., illus. McGraw-Hill Book Co., Inc., New York. (1957) $7.50

The popularity that the forerunners (1943, 1951) of this volume have enjoyed is indicative of both the tacit and enthusiastic approval of many persons concerned with the teaching of general biology. It is gratifying that this, the third edition, is in many ways an improvement on the former two. It has the distinct advantage of seeming to be more in keeping with what one expects of a textbook, and without a loss of usefulness, much of the encyclopedic quality of its predecessors has been suppressed. Nevertheless, there are few, if any, general zoology texts in which so much information is so readily available. Certain fundamental aspects of almost every discipline in the field of zoology are treated—some of them briefly, but always concisely and to the point.

The plan of the book is well conceived, and the text is lucidly written. It is divided into two parts, the first concerned with the principles of zoology. Here, using the frog and man as focal points for the most part, the breadths of the principles are made evident by repeated references to invertebrate types. Following a series of chapters dealing with structure and function are those devoted to reproduction, heredity, distribution, and evolution. The second part of the book consists not only of a sizeable parade of the animal kingdom but also contains a wealth of well organized information concerning diversity within each group, life histories, ecological data, and often geographic distribution. From each major group a representative animal has been selected and an account of its structure and aspects of its physiology precede a survey treatment of its relatives. To this is appended a diagnostic classification of the group discussed. Frequent references to well executed figures, photographs, and to other pertinent sections of the book, together with a list of source materials and additional readings at the close of most of the chapters leave little to be desired. The appended glossary, an excellent feature of the two previous editions, has been maintained.

The few errors that occur within this volume are minor ones indeed. The format, with the two-column page, is a decided improvement over the earlier editions, and the addition of new figures and photographs have made it much more attractive and usable. All together, the reorganization, modifications, additions, and deletions have enhanced its appearance, value, and usefulness. *H. H. Hobbs, Jr., University of Virginia*

Population Studies: Animal Ecology and Demography. Cold Spring Harbor Symposia on Quantitative Biology. Vol. XXII. 437 pgs., illus. The Biological Laboratory, Long Island Biological Association, Inc. (1957) $8.00

This remarkable volume contains a wide variety of contributions ranging from broadly developed reviews and syntheses to very specific reports of research. Not the least important contributions are the discussions at the ends of the papers which make lively reading even though presumably somewhat edited.

The symposium was preceded by a sketch of general and comparative demography by LaMont C. Cole. It closed with concluding remarks by G. Evelyn Hutchinson who, in addition to commenting on differences of view expressed by the contributors and on the future of comparative demographic studies, took the opportunity to present a very detailed scrutiny of the niche concept. The 34 papers are grouped largely according to their emphasis on human or non-human populations, so that certain major topics are distributed through several sections.

It would be too much to hope that a symposium by students of human and animal populations, geneticists, theoreticians, experimentalists, and field ecologists would present a unified view of modern population biology. The symposium combines, without necessarily blending, presentations of subjects varying from the prediction of human fertility to powerful mathematical formalizations and machine computations of population behavior, with considerable attention to the facts of nature as exhibited by natural populations. What we have, then, is a series of presentations of results in one of the most complex fields of ecology by some of the foremost contributors. The reader will have to work hard to use this book, but it will be worth his while.

The contributions to human demography are varied, giving attention to such points as historial development of populations and mathematical models; it is the latter approach which comes closest to the subject matter of the rest of the volume.

Much of the attention of the animal ecologists was naturally given to the control of population size. In particular, the concept of density-dependent and density-independent factors received repeated and detailed discussion. Nowhere in the literature can one find as complete a discussion of these and related matters, each exponent writing in knowledge of the views of the opposition. This symposium appears to have been somewhat unusual in the degree to which fundamental disagreement of viewpoint was expressed and analyzed. The concatenation of Nicholson, Milne, Andrewartha, and Birch has provided us with much valuable material; but, again, we must work hard with it, for the concepts are elusive and complex. The terms themselves have contributed to misunderstanding, for they are misleadingly simple and ambiguously used; one hesitates, however to suggest the invention of anything more elaborate. It may be expected, however, that this volume will stimulate the formulation of more operational approaches; certainly the body of factual knowledge is vast enough to provide the background.

Several papers are devoted to analysis of fluctuations of population size in observed natural populations and manipulated laboratory populations; they add valuable reviews of old and new data directly related to the more general problem of the control of population size and distribution.

The book does not provide a real synthesis of present knowledge of population biology. Rather, it provides a series of reviews of material which would have to be organized in order to prepare such a synthesis. It is the detail and comprehensiveness of the individual authoritative presentations that will make this book useful to biologists in general and indispensable to ecologists and demographers. *W. T. Edmondson, University of Washington*

Morphogenesis: The Analysis of Molluscan Development. CH. P. RAVEN. 311 pgs., illus. Pergamon Press, New York, London, Paris, Los Angeles. (1958) $10.00

This book is not an essay on problems of morphogenesis, in which only those observations that relate to a few generalizations are discussed. On the contrary, it is a specialized survey of a small sector of the field in which an effort to achieve completeness is a salient feature. The subject is molluscan development and that alone is considered. Even in areas such as the comparative embryology of annelid and molluscan cleavage and larval stages, where the urge to generalize must have been well nigh unbearable, the book concerns itself solely with the Mollusca. As a consequence this work will be of limited use to non-specialists. For the embryologist and the invertebrate zoologist, however, it will be a necessary and invaluable reference work. And for that stray geneticist or biochemist who wishes to see some of the most staggering problems of development presented with clarity and accuracy this book will pose sobering questions.

It is a systematic, tightly-written survey of development in all classes of the Mollusca, including the highly individualistic Cephalopoda. Content is indicated by chapter headings: Oogenesis, Maturation and Fertilization, Cleavage, Gastrulation, Embryogenesis (of the larva), and Organogenesis (of the adult). In all instances there is a "Descriptive Part", including such cytochemical data as exist; and where possible a part on "Casual Analysis" is included. In the first chapter it is refreshing to find more than the usual lip service to the concept that differentiation begins prior to fertilization. This is a period of development that, largely for technical reasons, has received little attention. It may be hoped that the importance of this period, indicated by its inclusion, and the paucity of information, revealed by this summary, will stimulate further study. Another especially valuable feature is the final chapter on organogenesis of the adult, an area almost completely neglected by the experimentalist. Perhaps this thorough treatment by one whose life has been devoted to analytical embryology will focus needed attention on these later stages.

Although the author has mostly confined himself to an orderly review of the literature there are provocative discussions of general problems. Among these the discussion of difficulties in the concept of organ-forming substances is particularly illuminating. While it certainly cannot be denied that the concept in its original naive form must be abandoned, I wonder whether Professor Raven's substitution of the term "morphogenetic substances" with its qualitative connotations goes far enough. Certainly the bulk of the actual evidence to date supports the alternative notion that the chemical differences within the early germ are in fact quantitative. It may, therefore, be more profitable to consider early ooplasmic differentiations as due primarily to differences in rate. At any rate it is clear that analysis of this fundamental problem is still in its infancy.

I have but one general reservation. In view of the fundamental nature of the problems presented by so-called mosaic development it is particularly desirable that the small number of biologists working on eggs of this type be increased. This book would better serve this purpose if there were more pointed emphasis on the gaps in the story and more suggestions for filling them with the aid of modern methods. For example, these eggs have not yet been studied with two of biology's most powerful tools, the electron microscope and modern cell culture techniques. The former in combination with other methods should tell much about the egg cortex (whose importance is discussed at length by Raven), while the latter may reveal unsuspected potencies in early blastomeres.

Finally, it should be emphasized that Professor Raven's intimate knowledge of the development of one molluscan species, *Limnaea stagnalis*, adds distinctive authority and insight to the analysis. Indeed, for many readers one of its most valuable features will be the inclusion within a single volume of the results of his own extensive and penetrating studies.

The book's overall usefulness is enhanced by subject, author and taxonomic indices. *J. P. Trinkaus, Yale University*

PLANT SCIENCES

Flora of the British Isles, Illustrations, Part I. A. R. CLAPHAM, T. G. TUTIN, and E. F. WARBURG. 144 pgs., illus. Cambridge University Press, American Branch, New York. (1957) $5.00

The publication of a new *Flora of the British Isles*, by Clapham, Tutin, and Warburg, in 1952 filled a need felt for half a century. The three authors of that work, all with modern training in genetics and ecology as well as with a keen knowledge of British plants in the field, produced what has been considered an outstanding manual, usable by professional botanists, amateurs, and students alike. The *Flora* was illustrated only by occasional figures showing special diagnostic characters. The artist, Sybil J. Roles, worked closely with the authors to prepare illustrations of practically all the included species. These full illustrations, of course, could not have been included in the manual without a complete change of format and great expense.

That the illustrations are now being published as supplementary parts of the *Flora* is good news to those who have used the text. The first volume of illustrations contains 552 line drawings, uniformly arranged four to a page; it is expected that three further volumes will be needed to complete the work. The arrangement of species follows the order of the *Flora*, and in this first part the plant groups between the Pteridophyta (ferns and fern-allies) and the Papilionaceae (legume family) are included. Botanists will recall that the *Flora*, like most British works of its type, follows the logical Bentham & Hooker system, with some alterations to bring it more into line with modern ideas of phylogeny. Of the 139 plant families recognized in the *Flora*, 49 are included in the first volume of illustrations.

The drawings themselves are of distinctly superior quality, although somewhat impaired by a uniform reduction to a size of about 4.5 by 3 inches. The craftsmanship, however, is excellent, and one feels that the drawings will in most cases permit recognition of species, although identifications should be checked by reference to the text. Certain species have been omitted from the drawings, and therefore the text is essential; the drawings alone do not comprise an identification manual. Most of them were made from fresh material and consequently show the general appearance of the living plant. In showing small parts a conventional, rather than strictly naturalistic, style has been effectively utilized.

The artist, Miss Roles, and the three authors of the text are to be congratulated upon the appearance of this first volume of illustrations; the printer has also made a significant contribution to the quality of the work. Botanists and others interested in the British flora, which includes many plants familiar in North America, will anticipate with pleasure the continuation of this series of illustrations and the eventual completion of this essential part of the *Flora of the British Isles*. *A. C. Smith, National Museum.*

★**The Physiology of Forest Trees.** Edited by KENNETH V. THIMANN with the assistance of WILLIAM B. CRITCHFIELD and MARTIN H. ZIMMERMANN. 678 pgs., illus. Ronald Press, New York. (1958) $12.00

The fundamental aspects of the physiology of trees has received but little attention by plant physiologists. This book consists of a series of papers presented at the first International Symposium on Forest Tree Physiology held at the Harvard Forest April 8-12, 1957. The aim of the symposium was to consolidate the knowledge of forest tree physiology now possessed, and to stimulate the search for more. This edited volume seems to be a good summary of the knowledge of forest tree physiology to date. It should be a stimulating influence toward more research in a much neglected field.

The editor and the contributors are to be commended for the fine quality of this book. An edited volume of contributed papers can hardly be expected to have the smooth continuity of a textbook. However, the nine parts of this book, consisting of a total of 35 papers are arranged in such a logical fashion as to make this an acceptable text. The book has the advantage of much greater detail and documentation from the literature than would be expected in a textbook.

The papers provide a wealth of ideas and methods which should make this book

an excellent reference source for researcher and student alike. This reviewer found the discussions following the papers very stimulating. The editor and the publisher are to be complimented for including the comments of the participants in the symposium. It is regretable that there is not a comparable book available on the physiology of cultivated trees. *E. C. Maxie, University of California, Davis*

★Introductory Plant Science. (Second Edition.) HENRY T. NORTHEN. 718 pgs., illus. Ronald Press. (1958) $6.75

The second edition of this successful textbook retains its commendable objective in presenting the beginning student with a simple, straightforward and challenging introduction to plant science. To awaken the student's interest and sharpen his curiosity about plants, the importance of BOTANY to human welfare is dealt with specifically in the first chapter and is interwoven throughout succeeding chapters.

The textbook is amply illustrated with new drawings and many original, often unique photographs. However, the latter vary markedly in quality of reproduction and illustrative value. Figure legends are lucid and frequently supplement the visual information of the illustrations. Although the format and sequence of chapters is essentially unchanged, many of the 40 chapters have been revised to incorporate up to date information or additional topics. A self-pronouncing glossary and review questions at the end of each chapter are noteworthy additions to the present edition. *Katherine S. Wilson, National Institutes of Health, Bethesda, Md.*

MISCELLANEOUS

Tracer Applications for the Study of Organic Reactions. JOHN G. BURR, JR. 291 pp. Interscience Publishers, Inc., New York. (1957) $7.50

As stated in the preface, this book was written primarily for the organic chemist. Your reviewer, not being a chemist, has solicited the comments of several colleagues who qualify in this respect; their opinions are unanimous in agreeing that this is an excellent textbook from the standpoint of organic reactions. The author's aim has been to discuss the principles involved in using isotopic tracers and to compare the effectiveness of tracer techniques with that of other techniques available to the organic chemist.

The first chapter deals with general considerations of isotope methodology, the isotope effect, isotopic vs. constituent labeling, and the validity of results obtained by tracer techniques. Emphasis is placed upon the study of processes which can be followed only with isotopic labeling; examples of these are reactions of alkyl radicals with hydrogen and many displacement, rearrangement, and isomerization processes. The succeeding chapters deal with exchange reactions in various systems, free radical processes, molecular rearrangements, reactions of the carbon-oxygen bond, molecular structure, and several other subjects.

There is no discussion of the physical techniques involved in detecting stable and radioactive isotopes but a short list of reference books is given in an appendix. The main body of the text was written prior to 1955 with pertinent literature through the early part of 1955 listed in an appendix.

This book should be a valuable guide to those chemists searching for modern and powerful tools to study organic reactions; it is too specialized to recommend to readers unversed in the intricacies of modern research in organic chemistry. *William T. Ham, Jr., Medical College of Virginia, Richmond*

★A History of Nutrition, the Sequence of Ideas in Nutrition Investigations. ELMER V. McCOLLUM. 451 pgs. Houghton Mifflin Co., Boston. (1957) $6.00

Few men have done as much to advance our knowledge of nutrition as Elmer V. McCollum, Professor Emeritus of Biochemistry at the Johns Hopkins University. It is fitting therefore that a long needed history of this subject should at long last appear from the hands of a master. In twenty-eight chapters, the history of our knowledge of foods and nutrition is traced from antiquity to the present.

The story begins with an all too brief account of some pre-scientific ideas about foods. Succeeding chapters take up the history of the growth of our knowledge of the chemistry of foods and the basic food constituents, carbohydrates, fats and proteins. The second half of the book is devoted to the story of the discovery of the vitamins and the consequences of these discoveries.

The book is very well-documented and no student of the subject should be without it. A collection of portraits and expanded biographical data concerning the founders of the science of nutrition would have enhanced the value of an already indispensable book. *Morris C. Leikind, Armed Forces Institute of Pathology, Washington, D. C.*

Introduction to Protein Chemistry. SIDNEY W. FOX and JOSEPH F. FOSTER. 459 pgs., illus. John Wiley and Sons, Inc., New York. (1957) $9.50

As the title and preface suggest, this book presents, essentially in a survey form, the fundamentals of protein chemistry. It is an up-to-date, readable, and well-balanced text which should suffice admirably as the basis of a one semester course in proteins. To supplement the necessarily abbreviated treatments of many aspects of protein chemistry covered in the book, a bibliography of classical and recent publications is included at the end of each chapter. The material covered includes chemical, physical, and nutritional aspects of amino acids, and chemical and physical properties of peptides and proteins, including enzymes. Especially well-handled are the chapters on protein structure and denaturation. *Parkhurst A. Shore, National Institutes of Health*

5-Hydroxytryptamine. Edited by G. P. LEWIS. 252 pgs., illus. Pergamon Press, New York. (1958) $9.50

This book will be welcomed with enthusiasm by those interested in the fast moving studies on the physiological and biochemical aspects of 5-hydroxytryptamine, or serotonin as it is generally referred to in this country. This book includes papers and discussion presented at a symposium in London in April 1957 by a group consisting of many of the investigators primarily responsible for the rapidly expanding body of knowledge concerning this substance. Included in this well-referenced book are sections which discuss the occurrence and metabolism of 5-hydroxytryptamine, the physiologic effects of this substance on the cardiovascular system, its significance in anaphylaxis and carcinoid tumors and its possible role as a neurohormone in the nervous system. There are also rewarding sections on the pharmacologic effects of drugs which interfere with the action or metabolism of 5-hydroxytryptamine. *Parkhurst A. Shore, National Institutes of Health*

Methods of Biochemical Analysis. Edited by DAVID GLICK. Volume 5, 502 pgs., illus. $9.50. Volume 6, 358 pgs., illus. $8.50. Interscience Publishers, New York, London. (1957)

This series is valuable to researchers using biochemical techniques. Its objectives are to discuss recently developed or improved methods, to critically evaluate them and to give detailed instructions for the method(s) of choice. Previous topics have included chemical, physical, microbiological and animal assays as well as the basic techniques and instrumentation necessary to carry out biochemical determinations.

Volume 5 contains chapters on the assay methods for cholinesterases; biological standards in biochemical analysis; α-keto acid determination; microdetermination of cobalt in biological materials; activation analysis and its application in biochemistry; contamination in trace element analysis and its control; chemical determination of estrogens in human urine; and the infrared analysis of vitamins, hormones and coenzymes.

The topics discussed in volume 6 are new developments in the chemical determination of nucleic acids; the microbiological assay of nucleic acids and their derivatives; the determination of formaldehyde and serine in biological systems; new

methods for purification and separation of purines; assay of serotonin and related metabolites, enzymes and drugs; determination of transaminase; glycolipide determination; methods for the determination of thiamine; rapid electrophoresis in density gradients combined with pH and/or conductivity gradients and determination of hexosamines.

For the most part, the editors and the contributors should be commended for their success in carrying out the objectives of this series. The reviews are logically organized, well-documented and clearly written. Each volume has a subject index, an author index and a cumulative title index which add greatly to its usefulness. In general these two volumes are worthy additions to this valuable series. *James R. Gillette, National Institutes of Health*

Biochemical Preparations. Edited by DAVID SHEMIN. Volume 5, 115 pgs. John Wiley & Sons, Inc., New York. (1958) $4.75

The objectives of this series are to present reproducible methods for the preparation and/or purification of biologically important substances, to give the chemical and physical properties of these substances and to refer to possible alternative syntheses. In accomplishing these objectives basic principles are presented which may be applied to the preparation of other substances of biochemical interest. The inclusion of a list of biochemically important compounds which have been presented in "Organic Syntheses" and of a cumulative subject index contributes greatly to the usefulness of this series.

The preparations presented in volume 5 include dibenzyl phosphorochloridate; phosphatidyl ethanolamine; sodium phosphocreatine; aldolase; crystalline condensing enzyme; S-succinyl coenzyme A; cytochrome c and reduced cytochrome c; separation of nucleotides of ribonucleic acids; separation of 5′-desoxyribonucleotides; nicotinamide mononucleotide; S-adenosyl methionine; adenine-8-C^{14}; D-glyceric 2-phosphate; 2-deoxy-d-ribose; L-glutamine and D-glutamine; two alternative syntheses for S-benzyl-DL-homocysteine; homocystine and homocysteine; cyanomethylimidazole and imidazoleacetic acid hydrochloride; and formiminoglycine, formimino-L-aspartic acid and formimino-L-glutamic acid.

As is apparent from these titles many types of methods are demonstrated ranging from strictly chemical syntheses to the purification of enzymes. The detailed instructions are presented in the same format used in "Organic Syntheses" and are checked by competent workers in other laboratories. This volume is a worthy addition to the other volumes of this valuable series. *James R. Gillette, National Institutes of Health*

Advances in Virus Research, Vol. V. Edited by KENNETH M. SMITH and MAX A. LAUFFER. 376 pgs., illus. Academic Press Inc., New York. (1958) $9.50

This highly specialized scholarly volume is representative of the rapid progress that has been made during the last few years in gaining an understanding of viruses on a molecular and biokinetic level. Although dealing largely with observations on *Escherichia coli* phage and other lysogenic bacteria, influenza virus, that of foot-and-mouth disease, and the psittacosis-lymphogranuloma group of viruses, the subject matter in the various chapters has been carefully selected to give a good broad coverage of general fundamentals. Each chapter is supplemented by a comprehensive list of literature references, and there are useful author and subject indices for the entire volume.

The contributors and editors represent great diversity in background; yet the material is integrated better than that in many textbooks. Neither the title of the volume nor the chapter headings do justice to the wealth of useful information contained therein.

In his chapter entitled "Lysogeny," G. Bertani tells of the general properties of temperate bacteriophages, lysogenic bacteria, prophages, and the relationship of the latter to the bacterial chromosome. J. B. Brooksby reviews the immunological types, infectivity, geographic distribution, species adaptation, titration, multiplication, antisera, and the biophysical properties of "The virus of foot-and-mouth disease." In discussing "The mechanism of hemagglutination by influenza virus," Anne Buzzell and Martin Hanid elaborate the biological properties of the virus and the general characteristics of the hemagglutination reaction. The general principles, parameters, contour representations, and characteristics of reactants in "The measurement of complement fixation by viruses" are covered fully by Forrest Fulton. Ph. L'Héritier outlines adequately the experimental procedures employed in investigating genetic mechanisms, and the biological properties of "The hereditary virus of Drosophila." Genetic recombinations, radiation inactivation, and radiosensitivity of the capacity to reproduce are emphasized by Gunther S. Stent in his contribution on "Mating in the reproduction of bacterial viruses." Host-parasite relationships, immunity reactions, application of serological procedures, biochemical aspects, chemotherapy, and general properties of the human and animal "Psittacosislymphogranuloma group of viruses" are a few of the many topics treated by Herbert A. Werner.

The entire volume is characterized by editorial excellence and is reproduced in easily readable type on good quality paper. The binding is attractive and permits the book to open flat on any page. Most technical terms and abbreviations are defined the first time they are used in the chapter. *Claude E. ZoBell, University of California, La Jolla*

Advances in Genetics, Volume IX. Edited by M. DEMEREC. 294 pgs. Academic Press Inc., New York. (1958) $8.80

The six sections of this book are concerned with diverse topics of genetics ranging from mitotic recombination in microorganisms to sex determination in higher plants. In each section, an authority on the topic or organism treated brings the reader up to date. The book begins with "The Population Genetics of Drosophila robusta", by Hampton L. Carson, in which is presented detailed information on the distribution, ecology, gene arrangements, population variability and genetic nature of this species. The second section, by Haig P. Papazian, treats of "The Genetics of Basidiomycetes". In these fungi, mating systems, mutation, segregation, cytoplasmic autonomy and nucleocytoplasmic relations are described. The genera *Coprinus* and *Schizophyllum* appear to have been the subjects of most of the recent research involving these phenomena.

An important chapter is that of G. Pontecorvo and Etta Käfer entitled "Genetic Analysis Based on Mitotic Recombination". The authors believe that mitotic recombination may be of general occurrence in diploid cells and that it may replace a meiotic recombination in the genetic systems of asexual fungi. Details of principals, methods and results leading to the identification of linkage groups, order of genes and the nature of mitotic crossing-over are given for *Aspergillus nidulans*. And the possibility of applying mitotic analysis to higher organisms is stressed. The large amount of data assembled on *Aspergillus nidulans*, by this method, is pointed up by the next section of the book which is devoted to "An 8-chromosome Map" of this fungus by Etta Käfer. About 40 markers are assigned to eight linkage groups which, together with the most recent cytological information, indicate that *Aspergillus nidulans* has a chromosome number n=8.

In a chapter entitled, "The Inviability, Weakness, and Sterility of Interspecific Hybrids", G. Ledyard Stebbins comes to grips with some of the fundamental problems connected with the development of barriers of reproductive isolation, which prevent or restrict gene exchange between Mendelian populations. In his statement of the problems and marshalling of the evidence so far adduced concerning them, Stebbins discusses various aspects of incompatibility ranging from that found between parental chromosomes to that between embryo and surrounding tissue. His emphasis is always on the significance to the evolutionary process of any feature of incompatibility that restricts the viability of potential hybrids. By restricting himself to the dictum that the "erection of barriers of reproductive isolation" is synonymous with the "origin of species", Stebbins has not considered a certain segment of information that bears heavily upon the broader implications of the subject matter of his chapter, particularly with regard to specia-

tion. However, for the area he has chosen to cover, he has presented cogent material and thoughtful discussions.

The final section of the book concerns, "The Mechanism of Sex Determination in Dioecious Flowering Plants", and is written by M. Westergaard. This chapter provides a comprehensive coverage of the subject matter including both genetical and cytological aspects. Table 3 gives 39 species in 24 families where heteromorphic sex chromosomes are reported to be present in the chromosome compliment. If these reports were accurate the overall picture would be surprising against the general belief of a few years ago that heteromorphic sex chromosomes were rare among the higher plants. However, as Westergaard shows in Table 2, the number of well-established cases are few, involving 4 genera in 3 families. The phenomena concerned with sex expression in dioecious plants are not fully understood but are known to form a complicated network of interrelationships between the genetics and physiology of any given species. Westergaard's review of the subject should be a good starting point for an ultimate more complete understanding of it. *Reed C. Rollins, Harvard University*

Bone and Radiostrontium. ARNE ENGSTROM, ROLF BJORNERSTEDT, CARL-JOHAN CLEMEDSON and ARNE NELSON. 139 pgs., illus. John Wiley and Sons, Inc., New York.

This small monograph on bone and the effect of radiostrontium on bone is timely, authoritative and well written. The question of the hazard from radiostrontium has been much debated recently by both scientists and laymen, and it is good to have an authoritative treatment of the subject by a Swedish group who have been working on bone structure and metabolism for a number of years. In addition, the general subjects of the distribution of mineral salts in bone tissue as well as the ultra-structure of bone are well covered. The book is beautifully illustrated with many radioautographs, microradiographs, electron micrographs as well as many curves, charts and other illustrations. *Howard J. Curtis, Brookhaven National Laboratory*

★**Principles of Genetics.** Fifth Edition. E. W. SINNOTT, L. C. DUNN, and TH. DOBZHANSKY. 459 pgs., illus. McGraw-Hill, New York. (1958) $6.75

This is the fifth edition of an excellent text. The book first appeared in 1925 and has been widely used in university courses since that time. Emphasis has always been on principles with inclusion of illustrative applications. Numerous problems at the end of each chapter have added to the attractiveness of the book for classroom use. There are fewer problems in the present edition. They are better selected and improved. Several uninteresting mechanical problems have been replaced.

The present edition is quite up-to-date. It reflects somewhat more of the experimental approach than previous editions. The modernized illustrations are attractive and useful. In format the book has been changed considerably. Page size is enlarged and a two-column style has been introduced. This reviewer prefers a single column page, but the new format is modern and attractive. An English translation of Mendel's paper is again included. Every genetics student should read this classic. It is a convenience to have it within the covers of the text. The references have been moved from the ends of the chapters to the end of the book where they are classified and annotated. Journal citations have been largely omitted. This removes the material a step farther from the actual experiments upon which the principles are based. Even though reports of original investigations may not be widely used by students or instructors there are values in calling attention to the classics which have provided the foundation for a young science and in locating them with the appropriate chapters.

The organization of the chapters has been considerably improved in the recent edition. The greatest single improvement is in bringing the discussion of chromosomes nearer the section on the Mendelian principles. Chromosomes and the meiotic process are now introduced in Chapter 4 following the discussion of Mendel's principle of segregation. Examples of recent developments in genetics of microorganisms have been integrated into appropriate chapters. Some of the biochemical aspects including the chemistry of the gene are interwoven into the text. Two short chapters (27 and 28), however, tacked on at the end, contain basic and interesting material on the chemistry and organization of genetic material. The chemical nature of the gene might have been more appropriately placed earlier in the book.

The concluding chapter (29) is an excellent presentation of statistical inferences. Methods of reaching valid conclusions, so necessary in genetics, are emphasized. This is a real improvement although it might be more effective for use of students if it could be integrated into the sections where the material applies.

On the whole it is a very fine text, which is highly recommended for upper division courses. *Eldon J. Gardner, Utah State University*

★**Living Resources of the Sea.** LIONEL A. WALFORD. 321 pgs., illus. Ronald Press, New York. (1958) $6.00

The author of this provocative book sets himself the task of exploring the voids in fundamental research, apart from that already in progress, which would contribute significantly toward learning how to enlarge the yield of food from the sea in answer to human needs. In an interesting, informative, penetrating way he succeeds abundantly in his objective. He assumes that we have not yet learned how to exploit the food resources of the sea fully, that scientific research in time will show the way, and that there are gaps in present research programs which need filling. Fairfield Osborn in the forward to the book notes that "The striking characteristic of this book is that its author, with restless purpose, seeks to demonstrate not so much what is known as what is not known. While this book is replete with existing information concerning marine resources, its great significance lies in the fact that it so vividly emphasizes what still remains to be learned about the life within the most extensive element of our earth".

The work is written in a semipopular style, and is divided into two principal sections, Part I on the "marine wilderness" and Part II on the "resources of the sea". In the first part, after discussing the objectives of the book, the author focuses attention on important problems which must be solved before sea fishing can reach a level of technical competence commensurate with agricultural science, mindful of the fact that philosophies and technologies cannot be radically changed in a hurry, that it will take many years to amass the knowledge, to learn to apply it, and to persuade people to apply it. An especially good chapter entitled "Geography", richly illustrated with effective colored maps of the world, provides information on populated areas of the world, areas of protein starvation, economic activity, merchant shipping fleets, areas readily accessible by modern surface transport facilities, distribution of marine laboratories, weather and fishing, distribution of fishing grounds, and fertile areas of the sea. This is followed by a chapter on conservation ("intelligent use of resources") of biological resources of the sea; then by several on the importance in augmenting yields from the oceans of further study of taxonomy, of the sea as an ecosystem, of new harvesting technics and devices based on principles of the behavior of marine animals, of harvesting plankton, of farming salt-water ponds, of the role of pathogenic bacteria, fungi, and viruses on plant and animal populations, of poisonous marine species, of improvement of fishing vessels and gear.

Part II is concerned with a general survey of the principal groups of animals and plants which have value in human affairs, again emphasizing gaps in our knowledge of these groups and suggesting lines of research required to fill in the gaps: sponges, coelenterates, echinoderms, mollusks, crustacea, fin fishes, reptiles, mammals, and seaweeds.

In summary the author concludes, in part, that utilizing traditional marine food organisms and ways of harvesting them, the total world production could be increased by a factor of less than two; however, speculating more boldly upon new products, new methods of harvesting, full utilization of brackish inshore waters for farming, better methods of improving salt-water ecosystems (through fertilization, control of predators and disease, genetic improvement of stocks), adjustment of rates of harvesting to provide optimum yields, it should be possible to enlarge use

of sea resources much more greatly. At present no line of marine research is being supported excessively, there is a severe shortage of trained personnel and of facilities, and there is no simple, direct shortcut to full understanding of the proper uses of the sea. "The most economical, efficient way to reach that understanding is not to try to do it penuriously. If we really desire to exploit the sea fully, if it is knowledge that we need to accomplish that purpose—and that is the theme of this book—then we had better make the necessary costly investment and put full effort into the job of acquiring that knowledge."

Eleven pages of notes and references provide the reader with further source material. Dr. Walford's background as a teacher, investigator, author, editor, and Chief of the Fishery Biology Branch, U. S. Fish and Wildlife Service, are evident in the broad approach, realism, and authenticity which characterize his writing. Beginning, as well as experienced, marine biologists, administrators of government marine fishery agencies, commercial fishermen and processors, and philanthropic organizations should all find this book stimulating and very useful. *Melbourne R. Carriker, University of North Carolina*

★**The Tissues of the Body.** W. E. LE GROS CLARK. Fourth Edition. 415 pgs. Oxford University Press. (1958) $9.75

The new edition of this well-known text is intended as an introduction to microscopic anatomy for medical students. Although it has never come into wide use in this country, it is a scholarly work of high caliber and a most useful reference volume. The various chapters deal primarily with the tissues as such and not with specific organs into which they are organized. Thus there is a chapter on mucous membranes and glands, but no detailed description of the pituitary, pancreas, or other glandular organs. Likewise there is an able discussion of nervous tissue but no mention of the specialized sense organs. The chapters on bone, connective tissue, joints, and muscle constitute a major portion of the book, and blood, blood vessels, and lymphatic tissues receive extensive treatment. Curiously there is no mention of the reproductive tissues.

One of the author's aims is "to provide an introductory account of the fundamental problems of Anatomy with special reference to the application of experimental methods in the study of structural organization." The experimental methods referred to are primarily those derived from embryology and experimental morphology, such as extirpation, transplantation, tissue culture, etc. Passing reference is made to the chemical makeup of cells and tissues, but the volume contains only a hint of the amazing advances of histochemistry during the past two decades. Likewise electron microscopical findings are mentioned in several chapters, but the submicroscopic architecture of cells and tissues generally receives brief attention.

The usefulness of the volume as an introductory text would be greatly improved by the inclusion of more plates. As a reference work it remains extremely valuable.

Joseph G. Gall, University of Minnesota

The Evolution of Development. JOHN TYLER BONNER. 102 pgs., illus. Cambridge University Press, New York. (1958) $3.50

The developmental process which higher animals undergo has evolved, presumably, from simpler series of developmental processes undergone by lower organisms. The author carries forward a detailed discussion of the origin and function of development into considerations of its possible extension —as the species themselves evolve. These three topics constitute the subject matter

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of the three chapters which make up this published account of lectures delivered by the author at University College, London.

We are accustomed to thinking in terms of the origin and evolution of structures or of functions but less accustomed to thinking of the evolution and origin of processes. Dr. Bonner has taken the rather novel evolutionary approach to development, in the hope that, from this viewpoint, some of the problems of mechanism will be seen more clearly. As the author states in his opening lines, there is nothing new or original in the way of facts; the book is simply his way of holding an abstraction "upside down" in the hope that hidden features may reveal themselves, or take on deeper significance.

Bonner is a facile writer and the book reads smoothly. His knowledge of the literature of animal development, plant morphogenetics, and protozoology is excellent, and he uses innumerable well-chosen examples to illustrate his points. Students of embryology who read this work cannot help but be stimulated to additional investigations by the synthesis of ideas. This is perhaps the book's greatest usefulness, since it looks at the facts of development from other than the purely conventional viewpoint. At the same time, it is sufficiently conservative so that no one could suggest that the interpretations are illogical or radical.

The chapter on the function of development devotes considerable space to the possible role of gradients, and it is very refreshing to see some recognition given to one of the very few comprehensive theories of development, namely, the axial gradient theory of C. M. Child. More attention could have been devoted, with advantage, to the phenomena related to adaptation in cleavage. The extension of development into behavioral patterns involves somewhat more in the way of conjectural hypotheses, many of which are at the sociological-anthropological level.

On the whole, this brief book is stimulating and thought-provoking, and will benefit a field which is, at present, greatly in need of new ideas. *D. P. Costello, University of North Carolina*

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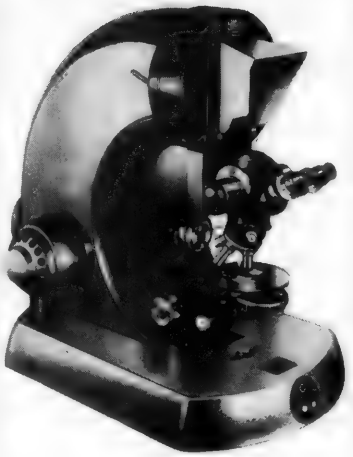

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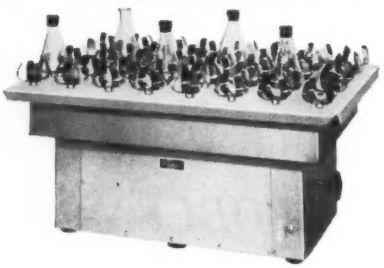

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